



# Surgery, Gynecology and Obstetrics

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# SURGERY, GYNECOLOGY AND OBSTETRICS

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## COMPRESSION OF THE SPINAL CORD AND ITS ROOTS BY HYPERTROPHIC OSTEO-ARTHRITIS

### DIAGNOSIS AND TREATMENT<sup>1</sup>

By HARRY L. PARKER, M.D. AND ALFRED W. ADSON, M.D., F.A.C.S., ROCHESTER, MINNESOTA  
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SINCE the publication by Bailey and Casamajor in 1911 of their report on a series of five patients suffering from damage to the cord and its roots from chronic inflammatory disease of the spine there has been very little added to the literature on the subject. From this may be deduced the relative rarity of the condition. It is however of considerable importance to be able to recognize it and differentiate it from other causes of compression myelitis, especially spinal cord tumors. Elsberg in his book on diseases of the spinal cord and its membranes admits the rarity of symptoms of cord compression in osteo arthritis of the spine but gives a report of a patient on whom an exploratory laminectomy had been performed and this condition found. The patient was relieved of his symptoms following the operation. Pastine reported a case of osteo arthritis in the cervical region with involvement of the cord. The patient had spastic paraplegia, loss of sexual power and slight sensory changes in the area supplied by the fifth and sixth cervical roots. Laminectomy was not performed. Sicard advised surgery in a patient who had a severe root pain but no other neurologic signs. After a stormy convalescence the patient made a good recovery. At operation the dura was found to be thickened and wrinkled. Two of Bailey and Casamajor's patients were op-

erated on. In one there was marked thickening of the laminae and spinous processes with softening of the bone which was grayish. The dura was congested but otherwise normal. In the other case there had been a previous injury to the spinal column and an overgrowth of bone was found compressing the cord almost at a right angle. Over the gibbus the dura was covered with granulation. The bone seemed healthy and was not softened.

The following case reports represent a further contribution to the whole problem both as regards diagnosis and treatment.

CASE 1: Mr J. McF. came to the Mayo Clinic January 7, 1924, complaining of inability to walk. He had had transitory pains in the shoulder and knee joints for 3 or 4 years, worse in damp weather and relieved by rest. Six months before coming to the clinic he had noticed a constant pain in the mid dorsal region as well as in the lower end of the sternum. At the time of onset of this pain he had furuncles in the right axilla which ran their course and disappeared in 6 weeks. The pain however continued, it usually began when the patient rose in the morning and became worse as the day went on, reaching its maximum at 5:00 p.m. Relief was obtained by going to bed. Bending his head on the chest caused a sharp pain in the mid dorsal region, also coughing and sneezing produced a similar exacerbation with pains radiating down the posterior aspect of both lower extremities. Four months before he had noticed numbness in the dorsum of his feet which in 3 months had ascended gradually to the lower end of the sternum and mid dorsal region. Weak-

<sup>1</sup> Read before the Surg. Assn. at Lake Park, Minn., Dec. 4-6, 1924.

ness and instability appeared simultaneously in the lower limbs so that the patient became unable to stand or walk alone although he had good power in the legs when he was lying in bed. The pain was insupportable while he was resting quietly in bed but on attempting to sit up or walk sharp paroxysms were produced.

The patient was a well built healthy looking man. Urinalysis blood counts and the blood Wassermann reaction were negative. Spinal fluid examination showed a negative Wassermann with a positive Nonne test; there were seventeen small lymphocytes to the cubic millimeter and the spinal fluid as yellow. There was no response to pressure on the jugular vein while the spinal fluid was being withdrawn. X-ray of the dorsal spine showed a slight hypertrophic arthritis but the lumbar spine and sacrum seemed normal. Neurologic examination revealed a marked anesthesia of the lower extremities and trunk which terminated at the third dorsal segment. This anesthesia was applicable to pain touch and thermal sensitivity vibration and joint sensations were equally involved. Motor power tested by bed was remarkably good considering the degree of anesthesia. The tendon reflexes were exaggerated but normal reflexes were elicited and Babinski's sign was noted on plantar stimulation of either foot. The patient's chief disability lay in the marked ataxia which prevented him from walking or standing alone. There was light tenderness on pressure of the spine at the third dorsal vertebra.

*Surgical exploration.*—January 16, 1924. The laminectomy of the first second third and fourth dorsal vertebrae or removal. The loc was made by a hypertrophic vertebra of the spine so that it was possible to break off the bone with a periosteal elevator. The spinal canal was markedly narrowed throughout the whole extent of the exploration but its narrowest part was opposite the third dorsal vertebra. The cord as normal in appearance but contracted. It was difficult to about five fifths of its normal size. The dura was not opened. There were no blood to palpate a tumor of the spinal cord and we felt that the contraction of the cord by a narrow girth of the spinal canal explained the neurologic symptoms. It was difficult to cut of the oozing from the soft porous bone and I felt that it was better to avoid opening the dura. The exploration was successful.

The patient was examined 6 months after the operation. At this time he could walk with a cane. The anesthesia had disappeared. The hypertrophy and inflammation of the Babinski's sign was still present as well as exaggeration of the reflex but the patient was remarkably improved. It was able to remain in former occupation.

The ultimate conclusion in this case could only have been that there was a focal compression lesion involving the cord. The previous transitory joint pains furunculosis and

the pleocytosis in the fluid might put one on guard as to the possibility of inflammation in the cord meninges or vertebra. The type of pain which varied so greatly with posture and movement was different from the spontaneous nocturnal pain in vertebral or spinal cord tumors. The marked loss of sensation out of proportion to muscular weakness was peculiar but might indicate that the maximal pressure on the spinal cord was posterior.

Roentgenologic findings in this case were of no assistance. At the time of operation when the lesion was exposed the plates were checked carefully for anything suggesting the gross bone disease that was encountered. The only evidence was a slight lifting at the edges of the vertebra such as might be seen in many patients without any symptoms of vertebral or cord disease. Furthermore a hypertrophic arthritis is common in the same area of the spine wherein a spinal cord tumor is situated. Elsberg and others have reported this repeatedly. Altogether the differential diagnosis between the condition revealed at operation and an extramedullary spinal cord tumor is a problem of great difficulty. The combination of pleocytosis in the fluid and postural pain seemed to be the only helpful factors in this case.

*CASE 2.* Mr. C. K. aged 55 years came to the clinic June 20, 1924 complaining of weakness in the left arm and leg and pain in the left arm. Five years before he had noticed a dull aching pain in the left elbow most marked while doing hard manual labor. This lasted about a year. Two years before a numbness in the left index finger with increased sensitivity and at the base of the finger and thumb. One year before he had noticed that the left hand tired more readily than the right and that the act of typing could not be done rapidly. A few months before a slight weakness of the left leg resulted in a noticeable limp. For a year he had noticed that coughing or sneezing produced a pain radiating down the medial surface of the left arm and forearm to the little finger. He had no pain at night but occasionally there was a leakage of urine when the desire to urinate was urgent also of feces after a cathartic. His sexual power was greatly diminished.

At the time of the examination the patient was a healthy looking man with a slight limp in the left foot. The spinal fluid test and blood Wassermann reaction were negative. There was a negative Nonne in the fluid and two small lymphocytes for each

cubic millimeter. The physical properties of the fluid were normal and there was a prompt response to jugular compression. Roentgenologic examination of the cervical spine revealed hypertrophic arthritis of the fifth, sixth and seventh cervical vertebrae moderate in degree.

Neurologic examination revealed a Brown Sequard lesion with weakness and loss of speed of the left upper and lower extremities. However the impairment was slight and the patient could walk and use the left hand for everything except very rapid and fine movements. The left leg was slightly spastic and tendon reflexes were increased on that side and the abdominal reflexes lost. There was Hoffman's sign in the hand and Babinski's sign in the foot on that side. The right upper and lower extremities were normal for power, speed and tone but there was a distinct anaesthesia in the right lower extremity and right trunk as high as the third dorsal skin segment. The patient was hyperaesthetic over the right index finger and metacarpophalangeal joints.

*Surgical exploration:* August 27, 1921 the spines and laminae of the third, fourth, fifth, sixth and seventh cervical vertebrae were removed. There was an overgrowth of bone in the body of the sixth cervical vertebra more pronounced on the left side so that the cord was pressed laterally and posteriorly. The cord opposite the body of the sixth vertebra was markedly congested and flattened. The dura was opened and left open. The patient was examined again a month after operation. He had more power in the left side and the sensory disturbance on the right side was less marked.

The hyperaesthesia of the patient's index finger and hand and the pain radiating down the center of his arm and forearm when he coughed or sneezed were relatively early symptoms and were given due importance in determining the level for exploration. The development later of a Brown Sequard syndrome indicated progression and although at time of examination the anaesthesia had reached only the second dorsal skin segment the level indicated by the root pain was given great consideration in determining the site of disease.

A cord tumor was selected as the most likely cause of his trouble partly because there was so little evidence before operation of gross vertebral disease and partly because the signs of cervical cord tumor early in its course are often even less marked than in the case of thoracic cord tumor. Roentgenologic examination revealed a narrowing in outline of the vertebral joints and margins and the findings were interpreted as

being due to hypertrophic arthritis. On the other hand there was little clinical evidence to support this assumption since there was no sign of cervical pain, rigidity or tenderness. However it was evident that there was a progressive focal compression lesion of the cervical cord and exploration. The findings at operation were as often happens in such cases a complete surprise and this case remains particularly baffling from the standpoint of the underlying disease.

*CASE 3.* Mr. G. A. S. came to the clinic July 22, 1924 complaining of pain in the back radiating into the posterior aspect of the left lower extremity and of weakness of the left foot. He had had intermittent pain for the last 15 years in the lower lumbar region and sacroiliac joints. This had never been severe and never lasted longer than 3 or 4 days. He had however been incapacitated twice by this pain and it was always worse on motion and relieved on rest. Five years before coming to the clinic he had driven a tractor 30 miles and was forced to stand with his weight on the left leg for the entire distance. Following this severe pain developed in the lower lumbar region and the posterior aspect of the left thigh. It lasted 30 days and he was in bed 3 weeks. Although he was kept awake at night the pain was much worse on motion and rest in bed afforded almost complete relief after the first week. He had had no further trouble until 2 months before coming to the clinic when a similar attack came on lasting 7 days. He was in bed most of this time. Five months before he had developed similar pains after heavy lifting. While lifting he noticed a sudden stabbing pain in the lower lumbar region and within 3 days it had become extremely severe radiating down the posterior aspect of the left thigh. Four days after onset a numbness appeared in the left leg and foot and a weakness in dorsiflexion of the foot. The pain had continued up to the time of his examination although it did not disturb his sleep it incapacitated him for work.

The patient was a well developed muscular man who walked with a limp and had to use a cane. He also wore a spinal brace to relieve any strain on his back. There was marked rigidity of his lower lumbar spine and spasm of the muscles in that area. Roentgenologic studies of the lumbar spine and sacroiliac joints did not reveal anything of importance. The spinal fluid was a very faint yellow but there was a prompt response to compression of the jugular veins. All other tests on the spinal fluid were negative. Neurologically the peroneal anterior tibial and toe extensor muscles in the left foot were paralyzed. The left Achilles reflex was absent. The patient walked with a steppage gait on account of the left foot drop. There was no pain on extending the left thigh on the abdomen and he was unable to sit up after lying down because of pain in his back.

*Surgical exploration* The laminae and spines of the twelfth dorsal of all five lumbar and of the first sacral vertebrae were removed. The six laminae were three times as thick as normally, the bone being very spongy vascular and soft with considerable bleeding. The spinal canal was found to be narrow particularly in the region of the second lumbar vertebra and the hypertrophy of bone was also most marked at this level. Above and below the hypertrophy gradually diminished extending perhaps not more than one vertebra above and below the second lumbar. The conus and cauda equina were somewhat atrematous and congested.

The patient had had backache for many years. The more recent increase of symptoms seemed dependent on stress and strain on the vertebral column and was relieved by complete rest. His first severe attack of pain followed the jolting and shaking of a 30-mile ride on a tractor. The second appeared spontaneously but the last and most severe attack from which the anterior tibial and peroneal weakness resulted was preceded by an undue effort in lifting a sick relative from bed.

So far as the history went the cause might have been one of spondylitis consequent on trauma and with severe root pain. The relation of pain to posture and exertion as evidenced by the fact that standing walking and lifting made it worse while rest relieved it might also indicate disease of the spinal column. The sudden paralysis of the dorsal flexors and evertors of the left foot might also be explained on that basis but it is an unusual complication. It was the appearance of a yellow spinal fluid and the slow response of its flow to jugular pressure that led us to assume a block in the spinal canal and advise exploration. Roentgenologic examination was of little value the findings being negligible or within normal limits.

**CASE 4.** Mr N. A. aged 23 years came to the clinic July 2, 1924. His chief complaint was pain in the back and weakness of the legs. He had had tonsillitis every winter up to February, 1924. Twelve months before coming to the clinic he had not had a morning burning dull pain in the lower lumbar spine. He also had an intermittent momentary sharp pinching pain in the right testicle two or three times a day. Ten months before the pain in which had organically occurred only in the daytime extended to the night and lasted until morning or later. It was worse on coughing sneezing taking a

deep breath or jarring his spine. It was worse on active labor but he could get almost complete relief by lying on a flat hard surface. Lying on a soft bed caused sufficient pain to awaken him at night. Seven months before examination he had noticed weakness of the left foot and diminution in sensation in the posterior part of the calf and ankle. At that time the backache began to radiate down the back of the thigh into his calf and ankle. The weakness in the left foot at first slight and only noticeable when he caught his toe in a rug increased so that he became unable to dorsiflex his foot at all. Three months before pain began to radiate down the back of the right thigh to the ankle and the muscles of the leg below the knee became weak. Sensory changes appeared in both lower extremities and ascended on the posterior aspect of the thighs to the buttocks around the anus and genitals. This disturbance of sensation was slight in comparison to the weakness. There was no pinprick tenderness. All the symptoms were progressive and the pain kept the patient awake at night unless a hard bed was available.

The patient was an apparently healthy young adult with a rigid lumbar spine. Spinal puncture at the fourth lumbar interspace produced a yellow fluid without any response to jugular compression. The pressure was 75 centimeters of water. Luncture in the tenth dorsal interspace and in the cistern produced a clear fluid with a good response to jugular compression and a mean pressure of 10 centimeters of water. The Kolmer test in the fluid was negative the Wernicke test was positive but there was only one small lymphocyte. It was difficult to get the needle through the intervertebral space in the lumbar region.

Neurologic examination revealed very marked weakness of all muscles below the knee as well as of the glutei. There was corresponding wasting lack of tone but no fibrillary tremors. He walked with a marked steppage gait. Tendon reflexes were reduced in the upper extremities and the patellar reflexes were more so although some response was preserved. The Achilles reflexes were absent as were the abdominal and the cremasteric reflexes were diminished. There was no Babinski sign. Sensory changes were slight and subjectively diminished in pain thermal and tactile extended as high as the eleventh dorsal segment although there was no absolute anesthesia. Vibrations sensibility was much more reduced over the ankles knees and crests of the ilium. Joint sensibility was however preserved.

*Surgical exploration.* Operation was performed August 16, 1924. The spaces and laminae of the tenth eleventh and twelfth dorsal and first and second lumbar vertebrae were removed. The laminae were very markedly thickened spongy and vascular and the spinal canal was narrow. The spinal canal was marked at the twelfth dorsal vertebra where it was almost completely obliterated. The dura was very much thickened rough in outline and congested.



Fig. 1 (Case 4) Roentgenogram of the spine in lateral view. Both the outline and shape of the vertebral bodies are normal.

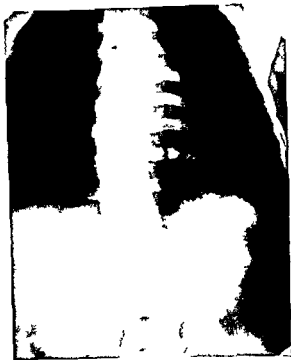


Fig. 2 (Case 4) Roentgenogram of spine in anterior-posterior view. There are slight changes in the vertebral discs but on the whole little is to be seen.

It was not opened. The narrowing of the spinal canal was sharply limited to the region of the twelfth dorsal vertebra.

Here again posture seems to influence the patient's pain. Walking, working, and any movement tending to jar the spine made the pain worse, and relief was obtained by lying flat on a hard surface so that the minimal strain was placed on the diseased spinal joints. It is relatively common for patients with spondylitis to complain of pain when lying on a soft bed where the spine can sag because as the muscles relax during sleep the tender surfaces of the vertebral joints are rubbed together, leading to sudden crises of pain which awaken the patient. Patients with a spinal cord tumor will get up out of bed and walk, the floor, sit up in a chair, or make certain movements which they find relieve the pain, but this patient found that any movement of his spine increased the pain; the degree of pain was dependent on the amount of movement to which he subjected the vertebral column.

Roentgenologic studies in this instance helped to exclude gross vertebral disease such as Pott's disease or sarcoma of the spine. The findings were meager and confined to a slight hypertrophic lipping of the lateral edges of the vertebrae and a narrowing of the intervertebral space which indicated absorption of the intervertebral discs (Figs. 1 and 2).

The neurologic findings were hard to explain satisfactorily. The patient had a marked weakness of the muscles below the knee supplied by the fourth lumbar to the second sacral segments; on the other hand, muscles supplied by some or most of these segments like the psoas, glutei, and rotators of the thigh were comparatively little affected. The sensory disturbance was not in proportion to the motor loss, and the sphincteric control and sexual power were not impaired. Such a dissociated lesion might be explained on the basis that the roots were more involved than the cord. The cord was however markedly crushed at the level of the twelfth dorsal vertebra, and medullary tissue is supposed to

be more vulnerable than root tissue. The canal was sufficiently narrowed to produce a block in the circulation of the cerebrospinal fluid. The demonstration of this block by combined cistern dorsal and lumbar puncture had satisfactorily proved the block to be somewhere between the interspace of the tenth and eleventh dorsal vertebrae and the interspace of the third and fourth lumbar. The intervening length of spinal canal was not too great to preclude surgical exposure. The yellow fluid below the block was additional evidence and laminectomy was advised chiefly on account of this block and the reasonable presumption that the disease process would proceed to the point of complete destruction of the conus medullaris.

CASE 5. M. W. S. aged 29 years first came to the clinic February 2, 1923, complaining of pain down the posterior aspect of the left thigh, leg and outer side of the foot. He had had influenza 3 years before and following this and undue physical exercise he developed a dull aching pain in the area supplied by the sciatic nerve at first present only in the daytime. This became progressively worse and continuous being so intense at night that the patient was unable to sleep. For a month he had walked the floor every night to get relief and had frequently slept in a chair. Three months before while practicing the broad jump he slipped but did not fall; however, in saving himself he writhed the lumbar spine. Following this pain was greatly increased and a numbness developed over the back of the thigh and the outer side of the left foot. Soon also developed the hand and shoulders tingling to the right.

The patient was a well built man with definite scoliosis. Roentgenologic examination of the spine revealed nothing abnormal. The spinal fluid was clear and colorless. The Nonne test was positive with several small lymphocytes. There was slight tenderness over the second and third lumbar vertebrae and flexing the head onto the chest produced pain radiating down the posterior aspect of the left lower extremity. There was no definite sciatic tenderness but the leg sign was positive. He had a well marked hypaesthesia to pain and to tactile thermal stimulation in the areas supplied by the first second third and fourth sacral segment on the left side. The left Achilles reflex was absent.

Surgical exploration. Operation was performed February 10, 1922 and a chondrosarcoma 15 centimeters in diameter was found arising from the intervertebral disc between the fifth lumbar and first sacral vertebral complex. It was situated to the left of the median line compressed the fifth lumbar root

and narrowed the spinal canal to one third of its normal diameter. It was completely extradural.

Following operation the patient did well and left the clinic free from pain. However the hypaesthesia persisted and also slight weakness of the flexors of the toe on the left side. He returned 18 months later complaining that the pain had recurred. Eight months after the operation he had had soreness and pain in the left calf with weakness of the left foot for 2 weeks. Nine months after operation he had resumed his former athletic feats. Seven months after the operation or a month before his second visit pain developed at the lumbosacral articulation and within 2 weeks radiated down the left thigh to the outer side of the leg and foot. The slight residue of his former weakness increased and the pain caused loss of sleep. The patient found that pain was greatly increased by sitting upright.

The sensory disturbance was more intense than at the previous examination but the area involved was the same. There was definite weakness of the left calf muscle and flexor of the toes and pressure over the lower lumbar area of the laminectomy would produce pain radiating down the lower extremity.

The site of the former operation was explored August 24, 1923, and considerable overgrowth of bone was found to have taken place in the cut edges of the laminae of the fifth lumbar vertebra so that the caudal roots were more compressed on the left side. There was no recurrence of the tumor the compression being anteroposterior of the bony hyperplasia. This was removed as a result the canal was widened and pressure on the nerve roots was relieved.

Examination September 25 showed marked improvement in both sensory and motor functions with slight residual findings. The patient was free from pain and able to move his spinal column freely with utopian or discomfort.

The history of this patient is very interesting since pressure symptoms on the cord developed following operation for fibrochondroma. This is the only case in our series of 200 laminectomies for cord lesion in which secondary symptoms due to an overgrowth of bone developed following laminectomy and it is fair to assume that his physical exertions and consequent trauma were not only of etiological significance in the formation of the fibrochondroma but also were an etiological factor in the production of excess bone formation on the cut ends of the laminae narrowing the spinal canal and producing secondary symptoms.

CASE 6. Mrs. P. L. aged 49 years gave a history very similar to that in Case 5. She had had recurrent attacks of pain in the lower lumbar region and

right sciatic distribution for 6 years. It was worse at night. This pain later involved both lower extremities with slight weakness and paræsthesia on the right. The pain was so marked that she became incapacitated for a time, then she improved but later had a recurrence of very sharp severe bilateral pain. Laminectomy with section of the spinothalamic tracts was advised. This had been done 3 months before the patient came to the clinic. The spines and laminae from the sixth dorsal to the fourth lumbar vertebra had been removed. No tumor was found and the left spinothalamic tract was severed. The pain was not relieved.

Neurologic examination here revealed sensory disturbance on the left below the fourth lumbar segment partially due perhaps to previous surgery. On performing lumbar puncture, however, spinal block was found to be present and the question arose whether a tumor could have been overlooked. Because of the persistence of this block, exploration was advised. Just prior to performing the laminectomy, 2 cubic centimeters of cerebrospinal fluid were removed from the fourth lumbar space. An air substituted severe pain down the posterior aspect of both thighs resulted and burning pain over a band like distribution below the umbilicus. On removing the air the pain was relieved. The laminectomy consisted of an exploration of the previous laminectomy wound and from the seventh dorsal to the third lumbar vertebra, revealing hypertrophy of the bone with a narrowing of the canal and pressure on the cord opposite the ninth dorsal vertebra. The canal was not only narrowed laterally but anteroposteriorly and at the site of the former operation. It was therefore difficult to secure as much exposure of the cord as was desired. We could not help but feel that the hypertrophic osseous tissue had existed at the former operation and accounted for the symptoms from the onset.

CASE 7. Mr. C. J., aged 48 years, came to the clinic June 4, 1923. He complained of difficulty in walking and loss of sexual power. Four years before he had noted a sharp stabbing pain in the lower lumbar spine when lifting heavy weights. This had increased so that his efficiency as a laborer had diminished. Three years before this disability was sufficiently great to warrant his leaving his work for 10 months and resting. Thereafter he had noticed a slight weakness of his lower extremities not sufficient to alter his gait but causing his ankles to twist under him unexpectedly. Until 18 months before coming to the clinic the weakness and the backache were not sufficient to prevent his working part time as a laborer in a coal mine but he had only 50 per cent of his normal efficiency and could not do any heavy lifting. Eighteen months before he had suddenly experienced a severe cramping pain in the lower lumbar spine which radiated down the posterior aspect of his lower extremities into the calves. This pain was extreme and continued for 16 hours at the end of that period he found he was paralyzed from his toe to his hip and that

there was a corresponding loss of sensation. His genital were hypæsthetic and his sexual power lost. There was, however, no sphincteric disturbance. The pain had never again been so severe as at the time when he became paralyzed but on unusual exertion turning in bed coughing, sneezing or jarring the spine it returned. It was always relieved by rest. The paralysis almost immediately commenced to diminish and within 8 months of the onset he could get around on crutches. Six weeks before coming to the clinic he discarded these and could get around with a cane. Three weeks before the ability to climb stairs had returned.

At the time of examination he complained of being unable to raise his feet high enough to avoid his toe catching in the ground and of residual numbness and loss of sexual power. His backache was sufficient to make him move cautiously and required plenty of rest to avoid severe pain.

The patient was a well developed man who walked with the aid of a cane. Both the blood and spinal fluid Wassermann reactions were negative. There was no pleocytosis in the fluid and there was a prompt increase in spinal fluid pressure on squeezing the jugular veins. The fluid was colored a faint yellow. Roentgenologic studies of the spine revealed nothing abnormal. Neurologic examination showed a weakness of the thigh muscles which was slight except for the hamstring. The peroneal, anterior tibial and extensor muscles of the toes were almost completely paralyzed, especially on the left side but the calf muscles were normal. There was a corresponding atrophy in the paralyzed muscles but no fibrillary tremors. The greatest disability was below the knees and in the muscles of dorsiflexion and eversion of the foot. Sensory changes were present and severe. On the anterior aspect of the left thigh (first and second lumbar segment) there was anæsthesia to pain, temperature and touch, that of the right thigh was normal. On both sides the skin below the knees the posterior aspect of the thighs, the buttocks, the perianal region and the genital were hypæsthetic. This hypæsthesia varied from severe to complete loss of pain, temperature and touch sensibility. The perianal area and the genital were less involved. To sum up on the left the whole of the lumbar and sacral distribution of sensation as involved but on the right only the third, fourth and fifth lumbar and all the sacral segmental skin areas were involved. Vibration and joint sensibility in the lower extremities was severely altered so that the patient was very ataxic. This added to his bilateral drop foot and gave him a peculiar ataxic and steppage gait. The patellar reflex was absent on the left side and diminished on the right. Both Achilles reflexes were absent. The anal reflex was preserved in spite of the disturbed sensation. There was no marked rigidity or limitation of the lumbar spine nor any tenderness.

*Surgical exploration.* Operation was performed June 14, 1924 and the spines and laminae of the twelfth dorsal, first, second, third and part of the



fifth lumbar vertebrae were removed. The bone was thickened spongy and vascular. The spinal canal was found to be so narrowed as to compress the roots of the caudal equina opposite the fourth lumbar vertebra into a band. On the left side the cord and roots were adherent to the dura and the lumen of the canal was almost obliterated. The clinical appearance was similar to that in fractures of this area which compress the cord without verifying that it is the cord nerve and roots were all adherent and compressed to the extent that the cord became indurated and a block was produced. The patient's convalescence was uneventful for 21 days when he died very suddenly following a stabbing pain in the chest which was felt to be due to a pulmonary embolus. Termination for necropsy was not obtained.

The patient was a Lithuanian unable to speak English and the history had to be taken through an interpreter. The patient was a coal miner subject to frequent injuries of a minor type but was never actually incapacitated by one. It was difficult therefore to evaluate his symptoms. The spinal fluid was yellow which indicated a partial block in the circulation of the cerebrospinal fluid. Thus and the early history of weakness in his lower extremities progressing slowly up to the point of the sudden exacerbation of pain and paralysis suggested a compression lesion. The progressive improvement was hard to explain but the disability still remaining after 18 months was sufficient to warrant exploration. In certain features this patient's disease resembles that in Case 4: preservation of bowel and bladder control and the motor weakness almost entirely below the knees and varying markedly in muscles supplied by the same or neighboring segments of the spinal cord. Thus the calf was almost intact while the peronei and anterior tibial muscles were paralyzed. The sensory disturbance in this case was much more marked and the maximal amount of narrowing was lower in the spinal canal than in Case 4.

At the time when the patient became paralyzed there was probably a sudden exacerbation of the osteo arthritis with pouring out of epidural periosteal exudate and crushing of the nerve roots at the intervertebral foramina and in the canal. The cord could not have been greatly damaged once good control of the sphincters remained. Some of the

inflammation must have subsided on the other hand some of it became organized leaving a permanent narrowing of the spinal canal. Corresponding to the degree of insult there was a partial recovery of nerve structures damaged by the compression and the patient came to the clinic during the period of improvement. How far it would have gone is hard to say but the surgical exploration revealed a condition not likely to clear up quickly.

**CASE 8.** Mr. E. R. aged 17 years came to the clinic November 29, 1923. Four months previously he had developed a swelling over the right supra-orbital region which went on to suppuration and abscess formation. This area was drained by multiple incision and pus was evacuated. Nineteen days after the onset left hemiplegia developed and days later generalized convulsions. For the 3 months preceding his visit the patient ran a fluctuating temperature and had another general convulsion. The right eye became more and more swollen and the globe protruded. Roentgenologic examination revealed extensive destruction of the bones and the diagnosis on admission was osteomyelitis of the skull with epidural abscess and proptosis of the right eye.

For 11 months the patient was under observation and care. There were periods of fluctuation in his condition when new abscesses would appear over the scalp and forehead and there was a constant profuse discharge of pus. Six weeks prior to laminectomy he began to complain of a bandlike pain around the thorax at the level of the third dorsal segment. Following this he developed a numbness in the lower extremities which ascended gradually to the level of his pain. He developed a progressive paraplegia within 6 weeks and there was a complete anesthesia with a sharp level at the third dorsal segment. Spinal puncture was made and yellow fluid was obtained which coagulated spontaneously. There was no response to jugular compression and the fluid was full of polymorphonuclear cells too many to count accurately. A cistern puncture revealed clear fluid above with no increase in cell count and there was a prompt response to jugular compression. Roentgenologic examination of the dorsal spine revealed nothing unusual. There was no marked tenderness or edema of the skin over the spine. On account of the evidence of a compression lesion of the cord with obvious block at the level of the third dorsal segment exploration at that level was advised.

**Surgical exploration.** The spinal and laminae were removed from the second to the fourth and fifth dorsal vertebrae. The principal obstruction was found opposite the fourth. The canal was narrowed by the hypertrophied cancellous and sclerous bone which had compressed the cord to the extent of

complete block (Fig 3). On opening the dura the cord was found to be densely adherent to the dura obliterating the spaces between the pia mater and the arachnoid. This mass was split dorsally and small yellow bodies 1 millimeter in diameter were encountered along the periphery of the cord. These were irregularly placed and while the center of the mass was perfectly red in appearance the substance containing the yellow bodies was grayish blue giving the impression that they were milium tubercles in inflammatory tissue. The incision was about 5 to 6 centimeters long but was not carried to the extreme limits as we did not wish to open up the subarachnoid spaces to obtain cerebrospinal fluid.

In this case there was more evidence of an inflammatory process involving vertebral meninges and cord than in any of the others. The operative findings were sufficiently similar to include the case in the series and although there was no actual suppurative process hypertrophy, porosity and vascularity seen in the other cases were present. Since the paraplegia had developed rapidly, it was our impression that an osteomyelitis of the spine had developed or that a localized abscess had arisen. The bony changes might be taken as suggestive of similar pathological processes in the other cases although an inflammatory focus was not so clearly demonstrated.

#### GENERAL CONSIDERATIONS

Seeing one case like the foregoing was enough to excite interest in the condition but eight such cases were observed at the clinic between August 1923 and November 1924. This comprised sufficient clinical material to make valuable an inquiry into the factors governing the disease.

All of the eight patients had received complete clinical and laboratory examinations, and surgical exploration was resorted to in each instance. The data required afford an interesting study and there seems to be a definite clinical syndrome established with certain diagnostic features and indications of appropriate treatment.

*Age and sex.* All of the patients were male adults and with two exceptions of good physique. Five were accustomed to hard manual labor and the risks incident to it. Three were in the second, two in the fourth and two in the fifth decade of life.

*Duration and course of the disease.* It would be hard to establish the actual onset of the disease since some of its symptoms are extremely common to all grades and classes of people. For example a backache is so frequent a complaint that no adequate idea can be reached as to when a particular pain later represented the onset of severe trouble. As soon however as symptoms of cord or root compression were established there was a fairly rapid progress in the severity of the symptoms and from that time until surgical exploration was undertaken the course could be easily followed. In one patient (Case 7) complete paralysis from the hips down took place within a few hours and in another (Case 3) a drop foot developed in an equally short time. In three patients (Cases 1, 2 and 4) paralytic cord and root symptoms had been progressing for 12, 4 and 7 months respectively crippling them so that they were incapacitated for active work. Apparently once the process of cord or root compression is established it progresses fairly rapidly and is a matter of months rather than of years.

*Location.* With the exception of the sacrum any part of the spinal cord seems susceptible to this disease. The lumbar area seems particularly susceptible since it was in this location that five patients noted suffering. In three patients the disease was in the dorsal area and in one the cervical spine was attacked.

#### SYMPTOMS

*Spinal.* The symptoms of disease in the spinal column were by no means prominent in any of the patients. In most of them any complaint referable to the bony and joint structures was dominated by the involvement of the nervous system. In no single instance was there a suggestion of a widespread spondylitis such as one sees in institutions that take care of chronic crippling diseases. In a few patients it was not even suspected that the disease was primary in the spinal column and secondary in the nervous system. Moreover the symptom of backache is as common in primary compression lesions of the cord as in secondary lesions due to bony disease. The pain was however somewhat different from that associated with cord

tumor in that it lacked the spontaneity so often seen in this disease. Pain independent of movement or posture was absent. There was no history of pain relieved by movement in any case and the story of walking the floor at night to relieve pain was singularly absent. Case 3 presents a fine point of differentiation in that while the patient had a tumor pressing on the nerve roots prior to the first operation and complained of spontaneous pains at night after this operation when an overgrowth of bone in the fifth lumbar lamina occurred his complaint was chiefly of a postural pain that was worse on sitting upright and was relieved by taking the weight off his spinal column. However in all the cases there was no complaint of deformity of the spine or of interference with breathing due to fixation of the costovertebral joint. Root pain rather than bone pain was the rule.

**Neurologic symptoms.** As has been mentioned the neurologic symptoms were predominant in the presenting complaint. The patients sought relief from root pain from paralysis of the muscles of one limb from inability to walk or as in the case in which the cervical cord was involved from weakness of an upper and lower extremity on one side. Spinalcortic disturbance was absent or slight in all but complaint of diminution of sexual power was made in two.

#### PHYSICAL SIGNS

**Spinal.** Evidence of disease of the vertebra was not prominent in the usual physical examination. With such severe neurologic signs one would expect more rigidity of the spinal column which is the cardinal point of diagnosis in spondylitis. It may also be present to a severe degree in cord tumor although never to the same degree as in spondylitis. In no case in the series was there complete rigidity of the spinal column with kyphosis. The findings at operation in Case 2 were a complete surprise in that at no time during the examination was there any rigidity of the cervical spine or any spasm of the muscles of the neck. There was no tenderness of the vertebra. In the other cases however there was some spinal rigidity and local spinal tenderness was specifically mentioned

in two but not to the same degree as in spondylitis. Moreover the same tenderness may be present in cord tumors. In Bailey and Casamajor's series signs of spinal disease were more marked. In one case there was marked scoliosis, pain and muscular spasm pulling the body to the right and in another there was severe pain on walking or with any movement jarring the spine. A history of spinal injury 18 years before with more recent sign of cord compression due to bony overgrowth was present in a third case.

**Neurologic symptoms.** In the literature on chronic osteoarthritis of the spine little mention is made of gross damage to the cord or roots. Usually however reference is made to root pains. These may be bilateral or unilateral and confined to one or more segments or spread over a wide area of the trunk, the severity varying in location. Local muscular paralysis has been seen and exaggeration inequality diminution or absence of tendon reflexes are again frequently mentioned.

Disturbance of sensation such as parasthesia, zonal hyperalgia and hyperesthesia receive attention but anything like the gross anesthesia seen in our cases or those described by Bailey and Casamajor seems uncommon. On the whole in the ordinary cases of chronic spondylitis focal compression lesion of the cord or roots leading to severe neurologic signs are not as common as in destructive bone lesions such as Pott's disease and malignant disease involving the spine. One of Bailey and Casamajor's five patients had a paraplegia dolorosa of three years duration with a sensory level at the twelfth dorsal segment. There was also diminution of reflexes and disturbance of the center for erection in this patient. Their second patient had a weakness of the thighs and pelvic girdle muscles without sensory disturbance or loss of sphincter control and in the fourth patient there were irregular areas of anesthesia with out motor or sphincter disability. The fifth patient had a compression lesion of the cauda equina due to bony overgrowth. Their case therefore represents an extremely varied group. In our patients the lesions were on the whole just as varied. The patient with involvement of the cervical region had a clear

Brown Sequard syndrome and the patient in whom the dorsal area was affected had a transverse level of anaesthesia without corresponding motor change. In the group of five patients with involvement of the lumbar and sacral cord or roots the clinical picture varied with the extent of the lesion but sphincteric disturbance was not marked in any of them and the lower sacral roots were spared to a surprising degree. In two patients the lesion was slight and involved one or two roots only with more marked motor than sensory change. In the others in whom the cauda equina and lower cord were severely damaged the distribution of muscular weakness was not uniform but patchy. Some muscles were severely involved and some seemed to have escaped. Whether the brunt of the damage was borne by the lower spinal cord (epiconus and conus) by the cauda equina or by the spinal roots at the vertebral foramen is difficult to determine.

*Lumbar puncture.* All of the patients had undergone this procedure as an aid to diagnosis. In a few the results were surprising and surgical exploration was undertaken on account of them. In most instances the jugular veins were compressed while the needle was attached to a manometer and the presence of a block in the spinal canal was estimated by the lack of response of the spinal fluid pressure to this maneuver (Quackenstedt test). The color of the fluid was noted and the Nonne and Kolmer tests were applied to each specimen of fluid with a cell count. The pressure of the fluid was noted before and after jugular compression. In the case of the patient (Case 5) who had a tumor removed and returned with a bony overgrowth of the vertebral lamina no lumbar puncture was made on his second visit. In five of the remaining cases a yellow spinal fluid under low pressure was obtained and there was no response to jugular compression in three of these. In two cases there was an increase in cells in the spinal fluid. The Kolmer test was negative in all cases but in three the Nonne test was positive. Spontaneous coagulation was not noted in any case. As to location of lesion in relation to block the patient who had a cervical lesion showed no such phenom-

enon but it was evident in the two patients with dorsal lesions. Spinal block was present in only one of the three patients with lumbar lesions on whom a lumbar puncture had been performed. In the patient whose only neurologic complaint was drop foot it is doubtful whether exploration would have been undertaken but for the obstruction of the spinal canal as evidenced by the yellow fluid. Also in Case 7 although the patient was improving slowly operation would not have been advised except for the same evidence of cord or root compression.

*Roentgenologic examination.* One might imagine that in the case of massive bony disease with hyperplasia and overgrowth found at operation the roentgenologic findings would be of great value. As a matter of fact the only value they possessed were to exclude destructive bony disease such as Pott's disease, tuberculosis, syphilis and cancer. Such positive findings as were present were slight and gave no idea of the actual change present. In many persons accustomed to hard labor, exposure and trauma and in persons beyond middle age some change in the outline of the vertebrae and vertebral joints might be expected. Actually they may be present and be symptomless. In senility such changes are the rule. In cases of cord tumor associated findings of hypertrophic arthritis and osteitis are extremely common and seem of no diagnostic importance. The findings in the majority of our cases were so slight and in view of the foregoing facts seemed of such minor importance that we gave them little consideration. Further in cases of spondylitis the bone and joints may show gross pathological alteration roentgenologically but no evidence of severe cord compression. Bailey and Casamajor had much the same experience. In two of our patients the roentgenologic findings were completely negative and in the others absorption and calcification of the intervertebral discs, small bony overgrowths from the margins of the vertebrae and haziness in detail of the margins of the vertebrae and transverse processes were noted. In lateral views of the cervical and lumbar spine no alteration in its conformation could be detected while in the

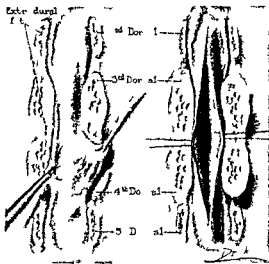


Fig. 3. Hypertrophic arthritis of the spine with associated inflammatory changes in the

spinal canal such alteration was vaguely outlined.

In uncomplicated cases of hypertrophic osteoarthritis the findings are similar. In the early stages when the symptoms are acute no change in the bone may be demonstrated roentgenologically. It is only when the process has been present a long time and permanent ankylosis deformity and bony change have occurred that roentgenologic studies are of value. Severe pain and tenderness may have ceased. Probably the overgrowth of bone in the early stages is soft and contains little calcium making it invisible in the roentgenogram.

#### PATHOLOGY

It is indeed difficult to classify the disease process present in these patients since the whole subject of chronic spondylitis is confused and difficult and inasmuch as the pathological alteration in these cases differs from that in the average case of chronic inflammation of the spinal column. There is little need here to discuss the difference between the types of chronic spondylitis described by Marie, Strumpell, Bechterew, Leni and others. The fact that so many different names are used such as spondylitis

deformans, spondylose rhizomelique, chronic ankylosing spondylitis and chronic hypertrophic osteoarthritis illustrates the lack of agreement as to essential character and definition of such diseases. For convenience the name chronic hypertrophic osteoarthritis has been used in this paper but we are far from assuming that this is the correct term or that it fully covers the whole disease entity.

Recently Nathan, after experimental work with dogs and a review of the previous discussion concerning the part the central nervous system plays in chronic hypertrophic osteoarthritis, came to the following conclusions. In all cases of osteoarthritis of the spine there is more or less irritation of the nerve roots by the periradicular exudate thrown out by the inflamed periosteum of the spinal canal and intervertebral foramina. This irritation may be severe as compared to local joint signs and neurologic signs such as local root pains and muscular paralyses. Hypertrophic changes in tendon reflexes may result. The joint signs may clear up and the neural remain or vice versa. In some of Nathan's animals there was a semi-solid opaque epidural exudate of irregular extent. In one case it extended from the median dorsal to the lumbar region. The vertebral veins were congested and the vertebral periosteum thickened with softening of adjacent bone. Nathan explains satisfactorily the cause of the diffuse neurologic signs in the ordinary case of hypertrophic osteoarthritis of the spine but his discussion does not include such gross focal compression and damage as was observed in our series. Were it only a matter of degree some analogy might be suggested but the neurologic symptoms were not merely severe but also focal. More over surgical exploration each time showed a limitation of the process to a few vertebrae which was just as would be expected from the clinical finding. The local vertebral change without marked involvement of the spine elsewhere was the unusual feature in our cases. There was a marked overgrowth of soft spongy vascular bone of from one to four vertebrae with thickening of the lamina and narrowing of the spinal canal at one focal point. The microscopic study of the bone re-

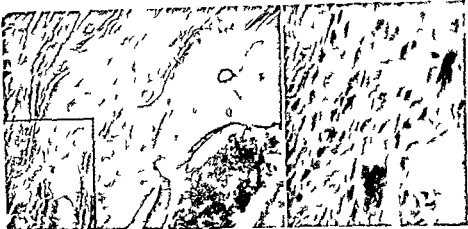


Fig 4 (left) (Case 1) Increased vascularity and inflammatory reaction of bone marrow thickening of trabeculae and increased number of osteoblasts  
Fig 5 (right) (Case 1) Proliferation of periosteum and increased number of osteoblasts and osteoclasts shown in the microscopic field

moved at operation might suggest an inflammatory process. There was an inflammatory reaction in the marrow spaces and proliferation of osteoblasts with active formation of new bone on the surface. The periosteum was thickened and edematous and there was an increase in the vascular supply to the tissue (Figs 4 and 5). Two of Bailey and Casamajor's patients had had a history of infections of joints other than those of the spine and there was an active suppurative process in one of our cases at the time spinal symptoms developed. There was a history of joint pains in Case 1 of our series previous to the development of paraplegia but in the other six cases no definite history of infection was elicited.

Trauma might be invoked as a contributory cause and one of Bailey and Casamajor's patients had evidently injured the spine many years before the development of bony overgrowth. One of our patients (Case 5) had had a laminectomy and contrary to the usual rule there was a bony hyperplasia in the cut edges of the lamina in one of the vertebrae. The fact that five (62.5 per cent) of our patients were strong muscular men accustomed to hard physical labor and exposed to repeated mild trauma to the spine especially the coal miner might indicate this as a predisposing factor. Actual chronic osteoarthritis is a disease more common in the laboring

classes than in the leisure classes. Possibly both infection and trauma are factors the former being the more common and prominent cause of the disease.

DIFFERENTIAL DIAGNOSIS

We have already indicated that it is not easy to be sure of the actual nature of the disease in these patients prior to laminectomy. Since they presented histories of pain motor disturbance sensory levels and spinal block surgery had been advised with the presumption of finding a cord tumor and instead of a cord tumor a hypertrophic osteitis was found which had produced the level symptoms. In view of our experience certain points seem to distinguish hypertrophic osteitis from cord tumor. (1) The type of pain in the former is more often secondary to posture movement or exertion and not spontaneous as in cord tumor. It is usually relieved by rest. It may be nocturnal but then due to posture and the patients do not tend to leave their bed and walk the floor. (2) Signs of local spinal disease which cannot be entirely accounted for by irritation of the nerve roots by tumor may be present. Extreme tenderness of the spinal column pain on jarring the vertebrae and deformity with muscular spasm may be observed in cases of tumor but are not so common. (3) A bilateral equal paralysis of radicular distribution with preservation

of segments lower down and without sphincteric disturbance is perhaps more suggestive of spondylitis than of cord tumor. The irregular character of the muscular paralysis in the lower extremities might seem to help in differentiation except that an ependymal cell glioma involving the cauda equina will produce the same picture. Certain muscle may be severely involved and others remain intact both in chronic osteoarthritis and in the large irregular gliomatous tumors that fill the sacral and lumbar canal.

Altogether a distinction between cases of cord tumor and chronic osteoarthritis is difficult to make and in certain cases one may well be in doubt. The roentgenologic examination while it does not help to distinguish spinal cord tumor from chronic osteoarthritis does help to rule out syphilis and tuberculosis of the bone since the vertebral bodies are seldom altered to the same degree as in the disease in question. Metastatic carcinoma sarcoma primary and secondary and local bony tumors are easily differentiated roentgenologically as are old fractures and rare diseases like echinococcus cyst involving the vertebra. The progressive history of the disease its focal character and the severe root pains are all signs indicating a compression lesion of the cord and if the possibility of destructive disease of the bone has been eliminated surgical exploration seems indicated even though the diagnosis is doubtful.

#### SUMMARY

Eight patients were seen in the Mayo Clinic between August 1922 and November 1924 who were suffering from a compression of the cord or its roots due to hypertrophic osteoarthritis. In all of the cases the lesion was focal in character and confined to from one to four vertebrae. In one patient the cervical in three patients the dorsal and in four the lumbar portion of the spine was involved. The disease may be due to an infectious process of the bone to trauma or to both. The symptom and signs were as a whole very similar to those in cases of extramedullary tumor of the spinal cord but the pain produced by the disease was less spontaneous and more influenced by posture

movement and exertion. Roentgenologic studies were of value only in excluding other diseases.

In five patients a yellow fluid was obtained on lumbar puncture and in three there was no change in the spinal fluid pressure on compression of the jugular veins. A partial or complete block in the spinal canal was diagnosed in 6 cases and verified at operation.

The pathological process was limited to a relatively few vertebrae. It consisted of an overgrowth of soft puggy vascular bone inflammatory in character and producing a marked narrowing of the spinal canal. This localized bony overgrowth was the most marked feature in the whole series and although the name hypertrophic osteoarthritis is used the bony changes were out of proportion to any joint disease.

Although it is difficult always to make a differential diagnosis between hypertrophic osteoarthritis (hypertrophic osteitis) and cord tumor one should at least endeavor to recognize and localize the level and the pressure on the cord since both cord tumors and hypertrophic osteitis require surgical intervention. The immediate results following decompression laminectomy have been very satisfactory but sufficient time has not as yet elapsed to give a definite statement regarding the ultimate prognosis.

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THE MECHANISM OF EPIDIDYMITIS<sup>1</sup>

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**E**PIDIDYMITIS secondary to infection of the posterior urethra and seminal vesicles develops as a result of extension of the process through the lumen of the vas deferens.

Extension of the involvement by way of the lymphatics to the epididymis has not been demonstrated either clinically or experimentally. It is impossible for infection to travel by this route because the lymphatics of the vas deferens drain into the inguinal and hypogastric region (8) and do not extend all the way to the epididymis.

Although it is possible for organisms to be carried along the sheath of the vas extension of the infection by this route does not often occur and it is doubtful whether epididymitis ever develops in this manner. Funiculitis is in a large number of cases an evidence of infection along the sheath of the vas from the vesical neck. Actual rupture of the distended seminal vesicle allows the contents to pour into its sheath. Incision of the funicular abscess may show the pus to be outside the apparently normal vas. This would indicate infection along the sheath.

That the organisms are not carried along the mucosa of the vas by continuity of the process as from the anterior to the posterior urethra is readily shown by the clinical as well as experimental evidence of the rapidity of the onset of the epididymitis and by the absence of involvement of the mucosa except at certain isolated areas.

All evidence points to the lumen of the vas as the path of infection. Epididymitis can be produced experimentally by allowing infectious material to pass up the ejaculatory duct (6). Following an epididymitis some pathology may be found in the intima of the vas but none about the vas. The rapidity of involvement and suddenness of onset also indicate this as the route of infection.

The actual mechanism of extension of infection along the lumen of the vas has how-

ever not been definitely determined. The vas deferens when stimulated undergoes true peristalsis from the epididymis to the posterior urethra. Peristalsis of the vas undoubtedly occurs during coitus. This peristaltic action of the vas was first demonstrated by Fick (4) in 1856 and since then confirmed by others in recent years by Waddell (10) and Macht (7). Lommel has shown that stimulation of the hypogastric nerves or irritation of the verumontanum produces active peristalsis of the vas toward the posterior urethra. None of the investigators have been able to note a peristaltic wave in the opposite direction toward the epididymis. The work of Low and Oppenheim claiming reverse peristalsis of the vas has not been confirmed.

It has been shown (6) however that when fluid is injected into the vas and the vas then stimulated the fluid progresses backward by gradual stages toward the epididymis following each peristaltic wave toward the posterior urethra and in this manner finally enter the epididymis. This mechanism is somewhat similar to that of bladder reflux and is most likely the manner in which epididymitis develops.

If the peristalsis of the vas ceases the foreign substance is arrested within the lumen of the vas in its regression. This may account for the frequency with which strictures of the vas are encountered when vasotomies are being performed in men who have never had an epididymitis. The organisms probably were arrested on their way to the epididymis and implanted themselves on the mucosa with the resultant inflammatory reaction later organization and scar formation.

Lommel (6) noted that bacteria will not pass up the ejaculatory duct from the posterior urethra if the verumontanum is normal but that infection extends up the ejaculatory duct when the verumontanum is inflamed or congested.



Belfield (2) has shown that it is possible to have urine pass through a needle in a vasotomy wound with a patulous relaxed ejaculatory duct. Most writers agree that mechanical irritation, trauma or inflammatory oedema of the verumontanum is necessary for the extension of the infection through the ejaculatory ducts.

This discussion is particularly concerned with the mechanism of the extension of the process after it has reached the tail of the epididymis. We have evolved what appears to be a fairly clear understanding of the mechanism of the epididymitis based upon an observation noted in the past by others but to which no particular clinical significance or importance has been attached. In attempting to inject fluid into the epididymis through the vas deferens we have found repeatedly that it is impossible to force any of the fluid much beyond the tail of the epididymis irrespective of the degree of pressure exerted or the length of time this pressure is applied. Neither low continuous pressure nor sudden high pressure made any difference in this finding—nothing could be forced beyond the tail of the epididymis. Our results were the same in the dog, bull and ram as well as the human.

It may be well at this time to review some of the more salient features in the anatomy of the epididymis for they have a distinct bearing, I believe, on the mechanism of extension of the infection.

The epididymis as it lies on the posterior surface of the testicle is somewhat crescentic in shape and about 5 centimeters long. It is closely invested by the tunica vaginalis except at the head and tail and is attached to the testicle particularly at both ends. Beginning at the conus vasculosus it is a single tubule very much coiled and twisted upon itself and is continued at the globus minor as the vas deferens. The coils of the tubule are held firmly together by areolar connective tissue. At the head a number of these coils are grouped and banded together by the connective tissue producing a compartment like formation. The entire epididymis except the tail is in fact blocked off into a continuous compartment of coils directed toward the vas

At the tail however this compartment formation ceases the coils becoming separated from each other although still held firmly together by the areolar tissue.

The tubule itself if unwound would measure about 20 feet in length. It is about 0.4 millimeters in diameter except at the tail where it is much thicker approaching very closely the size of the vas. The tail compares with the rest of the epididymis as does the large to the small intestine. The tubule is lined with ciliated epithelium and has a muscular coat of longitudinal and transverse fibers. The junction between the lower part of the body and tail is quite irregular; the tubule here is stated above separating out as a single coil and at this point making a number of acute angles upon itself. At this point the tubule also becomes much larger and thicker. The vas deferens meets the tail of the epididymis at quite an acute angle.

The tail of the epididymis is a development from the wolffian duct together with the vas deferens, seminal vesicle and ejaculatory duct (5) the body and head having been developed from the wolffian body.

A number of possible factors may be mentioned, one or all of which may have some bearing on the fact that it is impossible to force fluid up the epididymis.

1. The epididymis is a closed tubule containing secretion from the testicle that cannot very well be pushed back through its narrow lumen and cannot be made to back up.

2. The convolutions of the epididymis are directed toward the vas and any attempt to force fluid up the epididymis would almost necessitate the unwinding of these coils in the other direction.

3. The junction between the lower part of the epididymis and the tail has a number of acute angles and fluid before passing through would necessarily meet with this resistance. Sir Astley Cooper in his textbook published in 1841 (3) speaks of the difficulty encountered in injecting quicksilver into the epididymis and attributes this to the sudden turn the tube makes.

4. The walls of the tubule swell and link upon themselves when distended and prevent the upward flow of fluid.

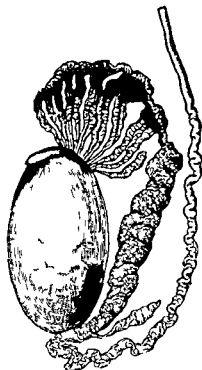


Fig. 5. C. T. from T. L. S. A. T. M. Col. Filas. Illustrating the anatomical structure of the human epididymis. The head and body of the epididymis show the component of the tail.

5. There may be valves at the junction of the body and tail.

Whatever the reason, fluid injected into the epididymis does not travel much beyond the tail.

We may now construct a theory of the mechanism of the development of an epididymitis secondary to infection of the posterior urethra and seminal vesicles. Although some of the conclusions arrived at still require proof and confirmation and may be disproved our findings seem to us to form a basis for an understanding of the mechanism of epididymitis that corresponds well with the clinical facts.

With the involvement of the verumontanum during a posterior urethritis organisms may be drawn in or carried up the ejaculatory duct. Normally the sphincter of the ejaculatory duct is in a tonic state of contraction. However, when inflamed it loses its tone and bacteria may enter and travel up. An oedema and partial or complete occlusion of



Fig. 6. Roentgenogram of the testis and epididymis of a rat. The epididymis was injected under pressure through the vas deferens with a 5 per cent sodium iodide solution. —none of the fluid got beyond the tail.

the ejaculatory duct on the side affected now occurs. The seminal vesicle which has been infected or now becomes involved has very little or no drainage through the swollen ejaculatory duct.

The organisms and pus in the seminal vesicle and ampulla increase in quantity and having very little or no means of egress are finally kicked back into the epididymis as a result of active peristalsis of the vas.

The dull pain and ache in the groin which usually immediately precede clinical evidence of epididymitis can probably be attributed to increased tension within the vas. We have attempted vasotomy at this stage in two instances but have not been able to prevent the development of the epididymitis although we believe that with this procedure the extent of involvement was minimized. This apparently indicates that the epididymis is already involved at this stage but presents no symptoms previous to inflammatory reaction and tension within.

This pain in the groin as a rule disappears when the epididymitis becomes evident. The

infectious process having then locked itself within the tail. We have noted that when fluid is injected into the epididymis and then allowed to escape through the vas it drains out very slowly, some of it remaining for a few hours. The inflammatory edema that develops when the epididymis is infected occludes the tubule at the junction of the tail and vas within 24 hours for the added reasons that the junction here is at an acute angle, the tubule becoming convoluted and drainage being very slow at this point.

At the junction of the upper end of the tail with the body, the upward extension of the process within the tubule becomes blocked as a result of the mechanical factors mentioned plus the inflammatory edema within the tubule. In this manner the organisms and pus become locked within the tail of the epididymis.

The tension within the globus minor increases and the inflammatory reaction of the surrounding tissues becomes more marked. The bacteria are now carried through the intercellular spaces, lymphatics and capillaries to the surrounding tissue, travel up, involve the rest of the epididymis by extension along the areolar tissue and peritubular tissue and produce a periepididymitis rather than an epididymitis.

With increasing intensity of the infection and inflammatory reaction the tunica vaginalis, both parietal and visceral, dartos and skin are also involved through direct extension of the process. Infiltration and involvement of the vas within the scrotum and in the inguinal region, which usually develops after the epididymitis has manifested itself, is probably due to direct extension from the tail of the epididymis.

With the subsidence of the involvement, the discharge as a rule reappears at the meatus. This may be due to the fact that the ejaculatory duct has again become patent and the infected seminal vesicle can drain. What it most often indicates, however, is that the mobilization of the defense mechanism of the tissues has shifted from the epididymis to the urethra where bacteria are still present and pus is thereby again produced.

The reappearance of the discharge at the meatus does not indicate, however, that the

epididymis is draining out through the vas and then the urethra, for the epididymis has in the vast majority of the cases become occluded because the tubule is destroyed, fibrous exudate has become organized and later scar tissue has formed. In those cases of epididymitis in which patency is restored, this is due to the absorption of the inflammatory product. Within a few weeks all the tissues within the scrotum and the head and body of the epididymis return to normal. The tail, however, remains hard and infiltrated, this infiltration being permanent and can be felt months and years following an epididymitis.

A number of findings may now be mentioned that are apparently contradictory to our conclusions that the process is particularly limited to the tail of the epididymis because of mechanical blocking of extension along the tubule.

1. The marked involvement within the globus minor merely indicates that the infection is most intense here and may well compare with an abscess or carbuncle in which there is marked involvement at the center and considerably less inflammatory reaction of the surrounding tissues. This accounts for the lesser degree of infection of the head and body and the other tissues within the scrotum rather than any mechanical factors. This also accounts for the rapid resolution to the normal of the rest of the epididymis except the tail where the organisms particularly localize themselves. However, if this is so, how can one account for the uniform intensity of involvement at the tail because the globus minor is invariably most affected? If there are no mechanical factors preventing the upward extension of bacteria within the tubule during life as we have noted with fluid injected, then it would seem reasonable to expect that one would occasionally find the head or body of the epididymis most affected, but such is never the case in epididymitis secondary to posterior urethritis or vesiculitis—the tail is always most affected.

2. Sections of the epididymis during the acute or subacute stage show some although relatively little evidence of infection within the tubule in the body and globus major. This finding does not necessarily contradict our con-



Fig 3 (left) Roentgenogram of testicle and epididymus of dog. Epididymus injected under pressure through the vas deferens with 50 per cent sodium iodide solution—passage of contrast fluid beyond the tail only.

Fig 5 (left) Testicle and epididymus of dog. The epididymus was separated from the testicle except at the gubernaculum and then injected through the vas deferens with a 50 per cent sodium iodide solution as a contrast fluid. Nothing could be forced beyond the tail.

Fig 6 Human testicle and epididymus with epididymus separated from the testicle except at the gubernaculum as in Figure 5. As shown here no fluid could be injected beyond the tail of the epididymus.

tention that the spread of the infection beyond the tail is peritubular rather than intratubular. Since organisms may traverse the intercellular spaces of the wall of the tubule and be carried by the lymphatics and capillaries from within out so also they may travel from within out thus accounting for the slight degree of intratubular involvement at isolated areas in the body and head.

3. Abscess following epididymitis is most often found within or around the tail or if outside the epididymis approximately at the junction of the body and tail indicating that here the extension upward intratubular was blocked and the tubule ruptured here. However abscesses are sometimes seen at the head of the epididymis but they are nearly always outside the tubule and may be accounted for by the localization of the bacteria after they have traveled up the sheath. It is well known that many years after an epididymitis when vaso-epididymotomy is attempted sperm will nearly always be found in the globus major and very often in the body.

4. It is of course possible that our post mortem and antemortem findings in which fluids injected into the epididymis resulted in blocking at the upper end of the tail would not hold at all good for bacteria in the epididymis

during life. In mild types of epididymitis the involvement limits itself entirely to the tail and the infiltration can be felt within the tail while the rest of the epididymis is apparently normal. If there is no obstruction to the upward passage of bacteria in these cases why does not the entire epididymis become diffusely involved rather than the tail only?

#### SUMMARY

Epididymitis secondary to a posterior urethritis or vesiculitis results from extension of the infection along the lumen of the vas deferens the mechanism here being the regression of the bacteria toward the epididymis following each peristaltic wave toward the posterior urethra.

Although no definite proof has been brought forth it is most probable that bacteria are blocked in their passage up the epididymis beyond the tail just as fluids are blocked experimentally so that the bacteria involve the rest of the epididymis by peritubular extension and not intratubular extension produc-

ing a pen epididymitis rather than epididymitis of the body and head

This may explain in part why it is that a gonorrhoeal epididymitis is practically never an epididymo orchitis but a pure epididymitis the organisms not having traveled up the tubule of the epididymis beyond the tail

This epididymitis rather than epididymo orchitis may also be accounted for by the resistance of the testicle to the gonococcus. It may also be explained by the fact that the tunica albuginea being of a different structure than the tunica vaginalis arrests the extension of the infection to the testicle (1)

If our deductions are correct then epididymotomy is an operation that should be limited to the tail of the epididymis for it is here that the process is intratubular. As performed at present it is more or less of a blind operation the whole epididymis being slashed in

many directions. Incision of the epididymis tubule does not increase the danger of occlusion as has been shown clinically and also experimentally with the vas deferens (9) because the epididymis undoubtedly has an equal regenerative capacity

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## AN ANALYSIS OF FORTY-ONE CASES OF THROMBO-ANGIITIS OBLITERANS

WITH A REPORT OF A CASE INVOLVING THE CORONARIES AND THE AORTA

By DAVID PERLA M.D. NEW YORK

F mth S g l r (D N h f) dth P th i g l D pa m t (D D t M )

THE purpose of this paper is to present an analysis of 41 consecutive cases of thrombo angutis obliterans studied at the Montefiore Hospital New York. These cases were under observation at the institution for periods varying from 2 months to 10 years. Nineteen had the disease from 1 to 5 years 14 from 6 to 10 years 4 from 11 to 15 years and 4 from 15 to 20 years.

## FREQUENCY

Of 10,000 cases listed in the records of the hospital 41 were cases of thrombo angutis obliterans giving a percentage of 0.4.

## ETIOLOGY

No etiological factor could be found. Previous infection apparently played no part. Syphilis did not occur in any of the cases. 36 gave a negative Wassermann reaction and 7 a plus minus reaction. Typhus fever (Goodman 1) occurred in but 4 of 41 cases. Twelve gave a history of moderate use of tobacco (Meyer 22 Wulff 35) 24 of excessive use 4 were non smokers. Though all but 1 of the patients were Russian Polish and Rumanian Jews no conclusions can be drawn from this fact since about 95 per cent of the patients at the Hospital are Jews.

Wieting (34) however reported cases among the Turks Whyte (33) among the Chinese Ludlow (20) among the Koreans and Koyano (16) Ito (14) and Todya (30) have seen it often among the Japanese.

## SEX

All cases were in males. Isolated doubtful cases in women have been reported.

## OCCUPATION

Though 10 patients were tailors every trade was represented.

## AGE OF ONSET

The age of onset ranged from 20 to 45. The youngest case was that of a man of 20. 3 were under 25 16 from 25 to 30 5 from 30 to 35 11 from 35 to 40 and 5 from 40 to 49. The greatest percentage occurred between 25 and 30 and the average age of onset was 32.5 (Fig. 1).

## PATHOLOGY

The disease has been described under various names<sup>1</sup> by many earlier writers (Friedlander 10 von Winiwarter 3 von Monteufl 31 Dutil and Lamy 7 Fraenkle 9 Wwedensky 36) but was erroneously believed to be a result of intima proliferation (Friedlander 10) or arteriosclerotic changes (von Monteufl 31). Though Friedlander suggested the possibility that the obliteration was due to thrombosis to Borchard (3) must be given the credit of establishing the thrombotic nature of the lesion. He definitely concluded that the process is one of primary thrombus formation in the peripheral arteries and veins with reorganization and recanalization and that it is distinct from arteriosclerosis. Buerger (5) has given a detailed description of the disease to which he gave the name of thrombo angutis obliterans and has established beyond doubt the thrombotic basis of the condition.

After amputation of a gangrenous limb in a case of thrombo angutis obliterans there was very little bleeding from the large vessels in the stump. Often the femoral artery was the size of a normal radial. The peripheral vessels popliteal and tibial were small stiff and matted together by adhesions with adjacent nerves. The lumina of the vessels were narrowed or completely obliterated by grayish

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denser connective tissue. Occasionally the recanalized vessels showed fresh clots in the lumen or complete closure resulting from fibrous constriction. By special staining Jores found an elastic membrane around the newly formed channels in the organized thrombus.

The veins showed relatively fewer changes. However mural thrombi in the process of organization and fresh clots were more frequently in evidence than in the arteries. Many of the peripheral veins were thickened, narrowed and occluded by the same process as the arteries.

The nerves. Early the perineural tissue showed cellular and fibrous tissue infiltration. In the later lesion the nerves in the vicinity of the vessels showed extensive fatty degeneration and fibrous replacement.

Arterio-sclerotic changes were often associated with the disease. Four of the 16 cases studied pathologically had definite arterio-sclerotic changes. The two diseases however are unrelated.

Buerger (5) described an acute phase with migrating phlebitis and cutaneous nodules which he found in at least 20 per cent of his cases. Only 2 of our cases gave a definite history of this condition. The acute thrombo-phlebitis showing purulent foci of polymorphonuclear leucocytes with giant cells in the peripheral portions of the thrombus was not observed pathologically in any case of our series. Buerger termed this lesion specific for thrombo-angiitis obliterans. He found it only in the veins during an acute phlebitis. It has never been observed in the arteries.

#### SYMPTOMATOLOGY

Clinically the cases fell into three groups: (1) early type limited to the lower extremities without gangrene; (2) chronic type with gangrene of one or both lower extremities; (3) chronic type with involvement of upper and lower extremities. The cardinal symptoms were sensory, vasomotor and trophic.

Pain was of several types. The intermittent pain and claudication that is so common in arteriosclerosis often occurred in these patients as the only symptom for from several months to as long as 5 years before the appearance of other symptoms. The pain was

generally in the calves (though it has been reported in the thigh) and probably resulted from vascular occlusion. Another type of pain was the sharp excruciating persistent pain localized under the nail of the toe or toes or at the seat of an ulcer. It was most intense when gangrene was impending and was amenable only to morphine. Sensations of formication, tingling, numbness and other forms of paresthesia commonly occurred. Reflex vasomotor phenomena of the superficial vessels secondary to the organic lesions in the deep vessels resulted in the early appearance of hyperaemia of the toes and dorsum of the foot associated with throbbing and burning at first alternating with cyanosis, numbness, tingling and coldness. They were later replaced by them.

Infections and ulcerations were common and often initiated the gangrene. They frequently followed slight abrasions and were at times the first sign of the disease. Gangrene developed as soon as 3 weeks and as late as 14 years after the onset of symptoms, the usual duration being between 1 and 2 years.

Duration of symptoms before the development of gangrene or amputation

	Cases
Less than 1 month	2
One to 3 months	7
Four to 6 months	8
Seven months to 1 year	4
One to 2 years	11
Two to 3 years	4
Five years	1
Six years	1
Seven and one half years	1
Nine years	1
Fourteen years	1

The disease involved 2 or more extremities in 35 cases. In 7 all 4 were involved. The right lower extremity was affected first in the largest number of cases.

Though the disease was often progressive without any periods of improvement, remissions were common. In 10 cases there were no symptomless periods (all of these were less than 4 years in duration). The longest remission was fifteen years. The greater number were symptomless for 1 or 2 years of their course.





death from causes other than thrombo angitis obliterans. The disease must be differentiated from other conditions that cause gangrene. Gangrene due to an injury from without resulting in destruction and thrombosis of the artery, thermal gangrene following extreme cold and prolonged exposure resulting like wise in thrombosis develop within 48 hours. Embolic gangrene secondary to myocardial disease is sudden in onset and offers little diagnostic difficulty.

In arteriosclerotic endarteritis obliterans with or without diabetes the age of the patient is usually over 50. Vasomotor phenomena, blanching and hyperemia are infrequent, gangrene which here may be of the moist type supervenes earlier after the first symptoms and progresses more rapidly, the physical manifestations of impaired circulation are few prior to the onset of gangrene, migrating phlebitis does not occur but marked varicosities of the superficial veins are more frequent. It is seldom found in the upper extremities. Arteriosclerotic gangrene is not limited to males nor to any racial groups.

Lytic endarteritis leading to the occlusion of the peripheral arteries of the extremities is extremely rare and can be differentiated from thrombo angitis obliterans only by the presence of other evidences of syphilis.

Periarteritis nodosa, an acute infectious disease with fever, nephritis, leucocytosis, etc., characterized by multiple focal thromboses and small aneurysms occurring in the arteries of the muscles and viscera, may in its early stages present symptoms of severe intermittent claudication (similar to thrombo angitis obliterans) referable to a wider distribution of vascular insults. The disease occurs chiefly in men between 25 and 50 and is rapidly fatal, lasting 8 to 12 weeks (Lamb 18).

Raynaud's disease is differentiated by sudden onset with local syncope or regional ischemia involving the fingers, more rarely the toes, and occasionally the ears and nose. Short duration of the sensory and vascular manifestations and their intermittent character and symmetrical gangrene and absence of arterial occlusion between the attacks.

Acrocyanosis progresses slowly developing a pharynx of the ends of the extremities

with local hypæsthesia is generally associated with pulmonary osteoarthropathy.

In erythromelalgia, a chronic localized hyperemia with pain and swelling (probably not a distinct entity) there is no blanching when the extremity is raised.

Sclerodactylia and scleroderma are generally symmetrical and though they may present vasomotor signs of asphyxia and syncope they are characterized by shortening of the fingers due either to a contracture of the skin or absorption of the terminal phalanges recognizable by X-ray.

### PROGNOSIS

The average life of the limb was 1 to 3 years after the onset of symptoms. There was no definite relationship between the duration of the disease, the number of the extremities affected and the number of amputations. In 4 cases of less than 1 year duration one or two extremities were amputated; in 4 cases of 3 years duration there were no extremities amputated; in eleven cases of more than 10 years duration three or four limbs were involved and there were two or three amputations. In general the older the disease the more extensive the destruction.

The duration of the cases in our series was from 1 to 20 years. One patient died of bronchopneumonia, 1 of pulmonary tuberculosis, 1 of sepsis following amputation.

There was 1 patient in this series whose death could be attributed directly to thrombo angitis obliterans of the aorta and coronary arteries. As far as can be ascertained no such case has been previously reported.

### TREATMENT<sup>1</sup>

The treatment of thrombo-angitis obliterans has at best been only palliative. Amputation is the only satisfactory symptomatic

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treatment. The method used for improving the circulation and diminishing pain are rest, basking hot air (incandescent lamp) and diathermy which afford some relief. Koga's (15) method of diminishing the viscosity of the blood by the use of hypodermoclyses of Ringer's solution has gained wide prevalence but has been found to be of doubtful value.

Steele (27) believing erroneously that the clotting time is shortened in thrombo-angitis obliterans, advocated the intravenous injection of 2 per cent sodium citrate. MacArthur (21) recommended duodenal flushings. All these treatments are tedious and must be continued for months. Their effects are at best transient. They have no effect on the pathological process.

The use of typhoid vaccine has apparently afforded some temporary benefit. It was observed that during an acute intercurrent infection with fever the pain was definitely diminished. Goodman and Gottesman (13) attributing this to the reaction to foreign bacterial protein introduced the use of typhoid vaccine (non specific protein therapy) in the hope of mitigating the vascular spasm that is generally superimposed on the pathological process.

The injection of 95 per cent alcohol directly into the main nerve of the affected part has been abandoned by Silbert (26) because alcohol results in tissue necrosis. The use of epidural injections of small quantities of novocain in saline as recommended by Strauss (29) in his treatment of sciatica may ameliorate the pain. Morphine should not be withheld from these patients for actually it is the one remedy that affords relief.

Ligations of the femoral vein (Oppel 23, Lilienthal 19) and arteriovenous anastomosis (Sastrustegen 25, Wieting 34, Goodman 11, Davies 6) are mentioned only to be condemned as dangerous and unphysiological. Lto (8) and Stetten (28) in reviewing a large series of cases report over 70 per cent failures. Amputation is generally resorted to sooner or later.

The following tabulation shows the number of amputations performed in cases of thrombo-angitis obliterans.

	Case
Right leg only	15
Left leg only, amputated	55
Right and left leg	13
No amputations	4
Right and left leg and fingers of both hands	3
Right and left leg, and 1 ft arm	1

### CASE REPORTS

The following 3 case reports illustrate the significant features of the disease.

CASE 1 is an early case of thrombo-angitis obliterans limited to the lower extremities without gangrene. In this type treatment may give fair results but the condition is generally progressive in spite of all efforts to the contrary.

CASE 1. 04118 H. C. a Russian tailor 46 years old, a heavy smoker with a history of apical tuberculosis 3 years prior to the present illness, entered the hospital December 3, 1920. Onset was 4 months previous to admission with cramp-like pains in the calf muscles of the left leg on walking, relieved by rest. He complained of coldness of the toes and feet especially in winter and found great difficulty in keeping his feet warm at any time. At times he felt a burning sensation in the dorsum of the left foot. On physical examination aside from a healed tuberculous condition in the left apex he presented no systemic abnormalities. His toes were cyanotic and cold and the pulsations of the dorsal pedal and anterior tibial arteries on both sides were absent. The feet on being raised blanched readily and the color returned very slowly when they were lowered. The blood pressure was 106-9, urine and Wassermann reaction negative. He received baking and 40 injections of Ringer's solution, 500 cubic centimeters at each injection administered by hypodermoclyses. On March 10, 1920 he was discharged improved symptomatically although the physical findings were unchanged. When last seen 3½ years later at the follow-up clinic he had been free from severe symptoms for more than 3 years. He still got occasional cramp-like pains in the calves which compelled him to rest. He occasionally felt some coldness in the feet but the burning sensation was gone. On physical examination both feet were cool but rubor was present all over the toes and the plantar surface of the feet. When the leg was raised 45 degrees the feet blanched but when it was lowered the color returned only after 20 seconds. The blood pressure was 112-80. The dorsal pedal artery anterior or tibial posterior tibial and popliteal arteries were not pulsating, the femoral pulsation was palpable on the right but very weak on the left. Though the patient had apparently improved symptomatically his condition was progressing. The patient was probably passing through a period of clinical remission. His later condition cannot be attributed to the treatment.

Case 2 illustrates the chronic type involving all four extremities with gangrene in the lower and upper extremities. Thus generally occurs in the cases of long duration though the upper extremities may be involved first. The patient in the following case was in the institution for 11 years.

CASE 2 Schiff Pavilion A K a Russian Jew age 40 a heavy smoker entered in November 1912. In his youth he had a severe nasopharyngitis with a complicating double otitis media which has since left him deaf. One year prior to admission he had immersed his feet in cold water after a Turkish bath. From then on he felt sticking burning sensations in both feet and found walking difficult. Pain was not very severe but 7 months later gangrene of the toe of the right foot developed and his foot was amputated at the Presbyterian Hospital. Gangrene developed in the stump a few months later and his leg was amputated. Pain coldness and cyanosis developed in his left leg within a few months. When he entered this hospital he complained in addition to pain of tingling and numbness in both hands and foot. On examination he had signs of involvement in his remaining three extremities. His toes were cold and cyanosed. The anterior and posterior tibial arteries were pulsating. Both hands were blue and cold and radial pulsations though diminished were palpable. The lungs showed some emphysema the heart showed no abnormalities. Pulses were equal and regular. The blood pressure was 115-80. Urine and Wassermann reaction were negative. Two years after the onset of illness and within a year of his admission the left leg was amputated because of the development of gangrene. For the next 3 years he was free from all severe symptoms. Then the symptoms of tingling pain and coldness returned to the finger of the right hand. The radial pulses completely disappeared. Within 4 months 4 fingers became gangrenous and were amputated. Then followed another period of relief for 4 years. Four fingers of the left hand then became cyanotic and painful and within a few months the index middle ring and small fingers were amputated in the order named. For the next 3 years the left radial pulse was not palpable and for the past 2 years he complained only of tingling burning and numbness in both hands. When examined in February 1924 thirteen years after the onset of this disease both hands and stumps of fingers and the stumps of both legs were bluish. The right radial pulse was imperceptible but the left was barely palpable. The right brachial pulsated strongly the left faintly. Neither femoral pulsations could be felt. Blood pressure right was 115-80 left 90-68. His general condition was excellent.

The pathological report of the amputated extremities showed advanced lesions of thromboangiitis obliterans in the vessels. The peripheral arteries were completely occluded by recanalized thrombi

the walls were thickened the intima being mainly involved and the nerve fibers showed fatty degeneration.

This case illustrates the slow but certain progression of the disease from limb to limb. Nevertheless there were periods of remission of  $3\frac{1}{2}$  and  $4\frac{1}{2}$  years a common finding in most of these cases.

In the following unique case the cause of death was thromboangiitis obliterans of the coronaries and aorta.

CASE 3 H K (02993) was admitted to the hospital September 25 1917. The family history was negative.

In the winter of 1900 the patient began to feel pain paresthesia and cold sensation in the left foot. This pain was followed by a bluish discoloration confined to the big toe. The toe became infected and was amputated. Four months later pain and cold sensation was noted in other toes of the left foot which became bluish and gangrenous. All were amputated in 1901 at Bellevue Hospital where he remained for 4 months. The foot did not heal and there was a severe slough from it. Pain persisted and the gangrene spread. In January 1902 a mid tibial amputation was done which healed in 2 weeks. He was free from all symptoms in this leg for 15 years. About 7 months prior to admission the entire stump began to pain and feel cold and became dark blue in appearance. This continued until June 8 1917 when the entire stump became painful and gangrenous. At Bellevue Hospital the stump was amputated above the knee.

In 1902 the right leg began to show a condition similar to that of the left paresthesia cold sensation and cyanosis and gangrene. In January 1903 the leg was amputated in the upper third of the tibia. About 1914 the patient's right ring finger became painful and gangrenous and was amputated at the German Hospital. Later the entire hand became painful and the patient claimed that the condition was relieved by hypodermoclysis.

On admission he had pains in both stumps and a gangrenous patch in the right stump.

Physical examination showed a middle aged man of 44 with amputated lower extremities complaining of severe pain in stumps. He slept in the sitting position on the left side of his body. There was cyanosis of the mucous membranes. The head chest lungs and heart were essentially negative. The skin was dry and the abdomen negative. The right hand had a purplish hue and became deeply cyanotic when lowered. When the arm was raised the entire hand rapidly became pale. The left hand showed the same changes. The right radial pulse was feeble than the left. The left leg was amputated about mid thigh the stump suppurating. The right leg was amputated at the mid tibial region with ankylosed knee. Cyanosis was evident up to

the mid thigh. At the end of the stump there was a large gangrenous area about 4 inches in diameter and very deep.

Urinalysis and Wassermann tests were negative. The blood pressure varied between 115-90 to 115-92 while in the hospital.

Between October 2 and 22 the patient received 8 hypodermoclyses of 500 cubic centimeters each. The left stump healed partially.

On March 5, 1918, the right leg was amputated at the middle of the thigh and healed with difficulty.

On January 27, 1919, the index finger of left hand was amputated.

On October 22, 1919, there was very little pain. The left stump had not entirely healed.

On June 5, 1920, patient's left thumb and forefinger became involved in a gangrenous process.

June 20, 1920, the left hand was amputated and the wound healed in 3 weeks.

October 19, 1920, the patient vomited twice, became cyanotic and died suddenly within a few minutes.

Autopsy was performed by Dr. B. S. Klein 83 hours after death.

**Internal Organs.** Thromboangitis obliterans (organizing) canalized thrombi involved the arteries of all extremities including external iliac arteries and left coronary artery. There was recent thrombus formation in the external iliac arteries and aorta as far as the renal arteries and gangrene of legs and hands. There were operation stumps in the upper third of each thigh, left wrist and base of right middle finger. Myocardial scars (1 ft). There was cardiac dilatation and left hypertrophy. Passive congestion of the lungs and abdominal viscera were of short duration (1 month). There were evidences of acute dilatation of the stomach and chronic pancreatitis. The probable cause of death was thromboangitis obliterans with extension of the process from the iliac arteries into the aorta as far as the renal arteries. The heart weighed 470 grams. Measurements: tricuspid ring 12 centimeters; pulmonary ring 8 centimeters; mitral ring 10 centimeters; aortic ring 7 centimeters; right ventricle length 3 centimeter; left ventricle length 15 centimeters. It was considerably enlarged; the endocardium was thin and delicate and there was a moderate amount of fat in grooves. The right auricle was moderately dilated; the tricuspid ring a limit of finger; the ring was moderately stretched. The right ventricle was moderately dilated especially in conus. The pulmonary ring was stretched the left auricle and ventricle moderately dilated. The myocardium on the left was moderately thickened. Mural and valvular endocardium throughout was thin and delicate. Coronary vessels beginning 1.5 centimeter from its orifice in the aorta, the main left coronary artery showed an organized canalized thrombus almost completely occluding the lumen for a distance of 2 centimeters. The process here resembled that in the vessels of the extremities. The right coronary

artery showed no abnormalities. On section the left myocardium and the muscle in general showed no appreciable abnormalities. There were however several depressed deeply gray areas replacing muscle varying in size from a few millimeters to a centimeter in its largest diameter.

**Microscopic Findings.** Myocardium palely staining. Modest fragments with definite localized areas of scar formation.

**Lungs.** All lobes voluminous, cushiony, soggy. Pulmonary vessels—no abnormalities. Bronchi—no abnormalities.

**Liver.** Moderately enlarged. Average consistency, capsule thin, surface smooth. On section lobulations regular. Tissue has a somewhat translucent appearance suggesting edema. There were scattered small yellow opaque flecks (fat). Call bladder normal.

**Spleen.** Weighted 20 grams. Considerably enlarged, consistency about the verge. Capsules slightly diffusely thickened. In addition there were two patches of thickening each several centimeters in surface diameter. On section soft but coherent pinkish gray surface present. Malpighian bodies not unduly conspicuous. There was apparently moderate increase in gray pulp. Trabeculae not appreciably thickened.

**Microscopic Findings.** Malpighian bodies well preserved. Hilar region of arteries.

**Kidneys.** Not removed.

**Kidneys.** Together weighed 300 grams. Some what larger than average. Surface smooth except for scattered small depressions here and there. On section the cortex regular in width averaged to 8 millimeters. Striations everywhere regular. Glomeruli more prominent than average. The medullary tissue also more clearly colored than average.

**Ureters and bladder** not removed.

**Microscopic Findings.** Tubules well preserved. Inner thickening of the vessel particularly involving the intima.

**Other organs** not removed.

**Illnesses.** Aorta—elasticity fair. There were scattered small soft yellow of gray and firm whitish plaques in the intima. The change was slight. The abdominal portion presented a striking picture. Beginning just below the renal arteries there was a moderate friable gray and red clot attached to the intima at the periphery, occluding the lumen. The clot was present throughout the iliac arteries where it was soft friable and a little pulled to the wall. The external iliac arteries in their distal portion showed organized canalized clot. Vessels of the upper extremities were not obtained.

**Microscopic Findings.** Intimal arteries—many sections showing all gradations from complete organization with canalization and calcification to freshly deposited thromb. The most marked changes throughout appeared in the intimal coat associated with great thickening, ulceration, round cell infiltrations and marked hyperemia of arterial wall (congestion of vasa vasorum).

Alimentary tract Stomach greatly dilated Mu-  
cosa congested covered by moderate amount of  
tenacious mucous Remainder of tract not removed  
Sections of pancreas Moderate general fibrosis  
with islands of Langerhans reduced in size and num-  
ber Pancreatic lobules widely separated by fatty  
infiltration

No doubt a careful follow up of all cases of  
thrombo angitis obliterans will reveal more  
instances of such fatal complications The  
possible association of coronary disease with  
this disease throws a new light on thrombo  
angitis obliterans

#### COMMENT

The etiology of the disease is still a matter  
of speculation The work of Rabinowitz (4)  
who claimed to have isolated the etiological  
organism has not been confirmed

Though earlier writers (von Monteuffel  
and others) confused the disease with endar-  
teritis obliterans and believed premature arte-  
riosclerosis to be the underlying factor the  
thrombotic nature of the disease was already  
recognized thirty years ago by Borchard and  
later by Wwedensky

Buerger's contention as to the specificity of  
the purulent and giant cell foci has been  
denied by Koyano (16) and Krampf (17) who  
claim to have found similar lesions in acute  
thromboses following infections Since we find  
early and late lesions in the same extremity  
it is interesting that in no case of our series  
was Buerger's specific lesion seen in the ves-  
sels of amputated limbs The disease may be  
considered as a prolonged chronic infection  
characterized by acute exacerbations One  
would therefore expect to find in some of the  
vessels of the amputated extremity evidences  
of the specific lesions since the final oc-  
clusion is often due to an acute thrombosis  
superimposed on a chronic process It is there-  
fore of some significance that Buerger's so  
called specific lesion is never seen in the  
deeper arteries or veins the primary seat of  
the disease The lesions described in the ru-  
grating phlebitis are in all probability not  
specific for thrombo angitis obliterans

There can be little doubt as to the infectious  
nature of the disease as Buerger first indi-  
cated The inflammatory reaction round cell  
infiltration etc even in old lesions suggests

this Though an etiological organism has not  
yet been proved this seems to be the field of  
most promising research

#### SUMMARY AND CONCLUSIONS

From an analysis of this series of cases the  
following conclusions are drawn

1 Tobacco typhus fever or other pre-  
vious infection play no part in the etiology  
The age of onset is usually in the second or  
third decade

2 The acute specific lesion described by  
Buerger is not found in the vessels of the  
amputated extremities The deep arteries and  
veins in the affected limbs show various stages  
in the process of organization and recanaliza-  
tion of thrombotic lesions

3 Acute phlebitis is an uncommon find-  
ing

4 Patients are generally in good health  
aside from their local condition

5 The extremity first affected is more  
often the right lower

6 Gangrene develops generally within 2 to  
5 years after onset of symptoms

7 The disease is characterized by periods  
of remission from months to years in which  
the patient may be free from all symptoms

8 The most important physical sign and  
indication of arterial occlusion is absent pulsa-  
tion of palpable arteries of the extremities  
This occurs months or years before the onset  
of gangrene

9 The capillaries are normal

10 Arteriosclerosis is sometimes associ-  
ated with the disease

11 All four limbs are often involved in the  
older cases The cause of death is generally  
an intercurrent infection Death from throm-  
bo-angitis obliterans of the aorta and coro-  
nary vessels may occur

12 The disease must be differentiated from  
the other causes of gangrene principally Ray-  
naud's disease arteriosclerotic endarteritis  
syphilitic endarteritis and from sclerodactyly

13 The present treatment is unsatisfac-  
tory

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DIATHERMY WITH METAL ELECTRODE AS A POSSIBLE ADJUVANT  
IN THE TREATMENT OF GONORRHOEA IN WOMEN<sup>1</sup>

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REPORTS on the treatment of gonorrhoal endocervicitis by diathermy have been so optimistic as to compel attention and this research was undertaken in the department of obstetrics and gynecology at the University of Minnesota in the hope that under this treatment gonorrhoea in women might cease to be the stumbling block that it has been in the past. During the last 10 years we have seldom cleared up our cases in the out patient department within 2 months and frequently it has taken 6 months or longer. It was reported that under diathermy only a few treatments were necessary to stamp out the disease. These reports were not accompanied by proofs in the nature of numerous negative smears taken over long periods but no doubt such checks were made.

At this clinic we have been unable to obtain such excellent results. We have made a study of more than 100 treatments and have checked them immediately before and after each treatment by cervical smears stained by the Gram method. I have personally given these treatments and have checked every smear and only those were called positive that contained Gram negative biscuit shaped recognizably grouped intracellular organisms unquestionably gonococci. The largest number of treatments given in any individual case has been 20. These treatments have extended over a period of 3 months and as yet we have not been able to discharge 1 as cured. It is a disappointing showing but not an unusual one if cures are based on proper microscopic evidence carefully obtained.

The rationale of diathermic action briefly stated is as follows. The tissues between the electrodes actually generate heat within themselves entirely apart from the actual heat in the electrode. That this phenomenon really obtains we proved by experiments on the anesthetized dog. With large metal mesh electrodes on opposite sides of the thigh

the temperature at the femur or approximately the middle of the thigh could be raised in a striking manner. That this heat was not caused by the temperature of the electrodes themselves was demonstrated by taking the temperature between the electrodes and the skin and substituting water jackets of the same temperature. The temperature at the femur immediately lowered. There is no question of the heat producing possibilities of diathermy within the tissues when large electrodes can be used. There is a great question however as to whether sufficient heat can be generated to kill bacteria within the deep tissues without injuring the superficial structures. Observations of experiments given later would prove that this is impossible. The relaxing and circulatory benefits of heat may be obtained but not the bactericidal results of higher temperatures. In the reports on diathermy in gonorrhoea it is the bactericidal action that has been maintained.

In this series of treatments the Corbus metal electrode was used in the cervix. This electrode is shaped like a straight hollow sound tapering at the end and it contains a thermometer by which one can accurately measure the temperature of the electrode in the cervix. In the early treatments the indifferent sponge metal electrode was placed over the pubis or the sacrum. Later a belt of 4 inch mesh was substituted under the belief that possibly the diathermic action might radiate from the cervical electrode in all directions. This is purely theoretical. It would seem the most likely that the current would choose the path offering the least resistance to the exclusion of all other radii emanating from the cervical electrode. It is my opinion that this is what really takes place resulting in an infinitesimal zone in the cervix subject to diathermy, the remainder of the cervix merely reacting to the actual heat in the electrode as indicated by the thermometer within the electrode. Practi-



cably the belt has proved more comfortable to the patient but the results have not been changed. In the early treatments a Corbus electrode  $1\frac{7}{8}$  inches long was used. Later this was shortened to  $\frac{3}{4}$  of an inch because it was found that as the temperature was raised the internal os would relax allowing the electrode to slip through with danger of extending the infection to the body. In 2 cases it was believed that extension occurred in this manner. The length of the electrode used should be changed according to the length of the cervical canal in each case in order to keep the electrode from entering the internal os. With these preliminary statements let us go on to observations on the actual treatments and the results obtained.

In the first 25 treatments all other therapeutic agents such as douches and topical applications of antiseptics were eliminated in order that the results might not be clouded. The current was increased very gradually up to the point of tolerance of the patient and this current was maintained for from 30 to 40 minutes. In most instances the patients could not tolerate a temperature above 118 degrees F in the Corbus electrode. It was soon learned that one must not depend upon the point of tolerance of the patient. Even 118 degrees F almost invariably caused a slough, none of a serious nature however. Many observations set the limit of temperature with the  $\frac{3}{4}$  inch electrode that would not cause a slough at 45 C or 113 F. As the gonococcus is supposed to die at a temperature of 108 F this allows a lethal margin of 5 degrees if the temperature in the electrode is any indication of the heat generated within the tissues. Experiments seem to prove that it is not a correct indication.

Now what local signs and symptoms obtain during a treatment? As the current is increased the patient begins to complain of a dull ache or of cramp like pains similar to menstruation cramps or a threatened miscarriage. The more slowly the current is raised the less marked are the symptoms but the point is finally reached when the patient can no longer stand an increase in current. This point of tolerance was always far beyond the temperature which would cause a slough

therefore one should be guided by the temperature within the electrode rather than by the pain tolerance of the patient.

During the treatment of 30 to 40 minutes a profuse cervical discharge is given off some times as much as 4 or 8 cubic centimeters. This profuse discharge accounts for the marked difference in the appearance of the smears before and after treatment. Whereas the smears before treatment may contain innumerable bacteria of many kinds and the usual field of pus cells some containing the gonococci the smears after treatment are practically free from all extracellular bacteria and the pus cells are fewer in number and generally more or less broken down. In most instances pus cells could still be found containing the gonococci. When this situation is analyzed one will conclude that this does not mean that the cervix is sterilized but that the cervical canal is cleansed for the time being by the profuse discharge. If the organisms were there and dead from the heat their staining qualities would not be changed as evidenced by flaming smears. That the organisms are still in the deep tissues is evidenced by the fact that in 24 hours the smears are the same as before the previous treatment.

The absolute failures of the first 25 treatments from the standpoint of destroying the gonococcus pointed to the conclusion that one would not be justified in withholding douches and topical applications. From then on diathermy was used to flush out the cervix preliminary to medication. For the past 3 years based upon experimental evidence we have been using a solution to cleanse the cervix preliminary to medication. This solution containing a half and half mixture of a saturated solution of sodium carbonate and peroxide of hydrogen. This mixture is prepared in each case immediately before its use. After its use smears from the cervix show as clear as after the diathermy treatment. Its use is less time consuming and less expensive to the patient. Theoretically from the standpoint of the profuse discharge caused by the heat in the cervical canal and possibly the diathermic stimulation of the cells it would seem plausible that diathermy might be a more efficient cleanser. This deduction is purely theoretical as we have

not tested the rapidity of the return of surface bacteria hour by hour after the two types of cleansing. As far as I can see the results with diathermy as an adjuvant to the old form of treatment with topical application etc. are no better and no worse than the old form of treatment alone.

One case was instructive from the standpoint of the possible use of diathermy as a provocative agent. This case was one of a girl who was sent in for examination because she had been accused of infecting a boy. Clinically the case was negative and she returned negative smears. As she was so normal in appearance she was chosen as a test case to determine the limit of temperature in the Corbus electrode which would not cause a slough. When she returned for observation 2 days later we were confronted with markedly positive smears. This instance is suggestive of the possible use of diathermy to float deep organisms to the surface but only suggestive as the smears might well have been positive without the treatment.

The application of silver nitrate is as we all know an excellent provocative agent and takes less time with less expense to the patient. When diathermy as a gonococcicide brought no results in the cervix where as we know the glands are deep it was thought that possibly a cure could be effected in the urethra more easily. With the indifferent electrode over the pubis the Corbus electrode in the urethra and the temperature in the electrode gradually raised to 112 degrees F. at which point most patients complained of discomfort treatment was continued for 15 minutes. Several treatments failed to clear the smears of gonococci. It will occur to all that possibly the diathermic action here did not affect the posterior wall of the urethra where Skene's glands are situated. To test the diathermic action the electrode was held close to the anterior vaginal wall against the urethra and a fever thermometer placed in the urethra. Distress rendered it impossible to raise the temperature of the electrode above 112 degrees F. when the thermometer in the urethra registered only 100.8 degrees F.

The same experiment was repeated on an anesthetized bitch in which animal the ure-

throvaginal septum actually measured only 2.5 millimeters in thickness. A temperature of 113 degrees F. in the Corbus electrode in the vagina for 30 minutes raised the urethral temperature to only 103.6 degrees F. A temperature of 140 degrees F. in the Corbus electrode at which temperature the electrode actually singed the vagina and caused an oedematous burn under the indifferent electrode over the pubes raised the temperature in the urethra to 106.8 degrees F. The dog had to be deeply anesthetized to keep her from evincing marked evidence of distress.

If it takes a temperature of from 106 to 108 to kill the gonococcus it would appear to be impossible to attain this temperature at a depth which would eradicate the deep organisms without superficial injury. This experimental evidence would account for the failure to eradicate the gonococcus from the cervix and urethra.

Postulating that possibly the size of the cervical electrode prevented the desired rise of temperature without cautery effects Drs. A. D. Hirschfelder and R. N. Bieter of the department of pharmacology at the University of Minnesota conducted thorough experiments on the anesthetized dog using large electrodes over large surfaces. They found that even under such conditions to obtain a temperature of from 106 to 108 degrees F. in the deep tissues damage to the skin resulted.

#### CONCLUSIONS

1. Diathermy with the metal electrode in the cervix is not a gonococcicide to organisms in the deep tissues at least with the use of amperage which can be borne by the patient from the standpoint of pain and which will not cause damage to the tissues.

2. Diathermy of from 30 to 40 minutes duration with the Corbus electrode registering 45 degrees C. or 113 degrees F. produced a copious cervical discharge which gives evidence from smears of having washed out the cervical canal and may thus be of value in preparing the cervix for medication.

3. It may be of value as a provocative measure before taking smears in doubtful cases.

4. An electrode long enough to enter the internal os should not be used in the cervix.

because of the possibility of extending the infection.

5 The fact that diathermy sometimes produces colic like pains resembling menstrual cramps or threatened abortion and that it frequently produces irregularities in menstruation suggests that it might be a dangerous treatment in pregnant women.

Brief case reports are given of 10 patients treated in the Dispensary of the University of Minnesota.

The method of treatment regularly followed consisted of the cleansing of the cervix with peroxide of hydrogen and sodium carbonate and the application of argyrol 25 per cent, mercurochrome 5 per cent or silver nitrate 10 per cent according to the chronicity of the condition. These reports bring out with great force the necessity of obtaining negative smears before pronouncing a case cured with any type of treatment. The cases must be cured both clinically and bacteriologically. It will be noted that in some of these cases treatment was stopped before cures were effected. Several of these patients were brought back by the Social Service Department and others disappeared and could not be found. During the time noted in the reports no cures were effected.

CASE 1. M. A. No 52845 noted a slight discharge for 4 or 5 months. She was sent in October 22, 1924, accused of infecting a boy. Smears were negative. Diathermy was given October 23, regular treatment on the 25th, diathermy on the 26th, 30th and 31st. When smears were positive. On November 3 smears were negative and diathermy was given. November 10 regular treatment was given. The smears were negative and the patient was transferred to the Minneapolis General Hospital.

CASE 2. A. B. No 47835 Gonococci held back since February 16, 1924. A regular topical application had been given up to August 9, 1924, when diathermy was tried and the smears were still positive. Regular treatment was given August 23 and 25 when smears were positive. Diathermy was given September 4 when smears were positive. Regular treatment was given again on September 9 and 16 and diathermy on the 23rd. The smears were still positive. The regular treatments followed by negative smears were given October 5 and 9. Diathermy was given December 4 and the smears were negative.

CASE 3. L. O. N. 47759 Smears were positive June 7, 1924. Regular treatments were given on June 10, 12, 14 (smears positive) July 2, 9, 11, 14

(smears positive) 16 (smears negative) 18, 23 and August 4 (smears positive). August 6 diathermy was given and smears were positive. There was a profuse watery discharge from the cervix. August 7 the flow began and continued with great pain. The tubes were removed at Minneapolis General Hospital on August 11, the diagnosis being bilateral chronic salpingitis.

CASE 4. I. M. No 50587 July 24, 1924 gonococci were present clinically. After regular treatment smears were negative. July 26 (smears negative) regular treatment was given. July 31 after regular treatment gonococci were present clinically but smears were negative. August 4 and 16 regular treatments were given and smears were positive. August 8 and 15 diathermy was given. Smears were positive. September 2, 6 (clinically positive) and 13 regular treatments were given and smears were negative. September 20 and 27 regular treatments were given and smears were positive. October 11 regular treatment was followed by negative smears.

CASE 5. M. D. No 50508 had a profuse discharge since July 7, 1924. July 21 regular treatment was given and smears were suspicious. On July 23 (smears negative) 25 (smears positive) 28 and August 1 and 14 regular treatments were given. August 6 diathermy was given and smears were negative. August 15 and 16 no treatments were given as patient was very nervous. August 18 (diathermy) 23, 30 (diathermy) September 6 (regular treatment) and 13 (diathermy) and October 4 and 12 (diathermy) the smears were positive.

CASE 6. I. V. No 51343 September 2, 4 and 8 regular treatments were given and smears were positive. September 10 diathermy was given and smears were still positive. September 11 regular treatment was given. September 12 (smears negative) and 15 (smears positive) diathermy was given. September 19 and 20 (smear positive) regular treatments were given. September 22 and 27 (diathermy) and 29 (regular treatment) and October 1 (diathermy) 3, 8 and 9 (regular treatment) the smears were positive. October 14 regular treatment was given and the smear was negative. October 16 diathermy was given and the smear was positive. October 17 regular treatment was given there was a slight gain and the smears were positive. October 20 diathermy with belt electrode used and smears were positive. October 24 regular treatment was given and smears were positive. On November 1 and 16 regular treatments were given. On November 3 a biopsy was made on the cervical slough.

CASE 7. C. C. No 10675 May 12, 1924 she had clinically gonorrhea to be present but smears were negative. Regular treatments were given May 14 (smears negative) 17 (smears positive) 19, 21, 24, 26, June 2, 4 (smears negative) 6 (smears positive) 9, 11, 14, 16, 18 (smears positive) 20, 25, 30, July 2, 5 (clinically gonococci) 7, 10, 12, 14, 16, 18 (smears positive) 28, August 1 (smears positive) and 5. Diathermy was given and smears found positive. August 7, 14 and 16, August 22 regular treatment

was given and smears were negative. Diathermy was given and smears found positive on August 25, 27 and 29. September 2 regular treatment was given and smear was positive. The patient left the dispensary and went under the care of a private physician.

CASE 8 J B No 45503 began treatment December 21, 1923. Regular treatments were given December 24, 26, 28, 31, January 2, 19, 4, January 4, 7, 9, 16, 18. Regular treatments were given and negative smears found on January 21, 23, 25, 28, February 1, 29, March 3 and 26. May 6 regular treatment was given and the smears were suspicious. May 16 the regular treatment was followed by a positive smear. Regular treatments were given June 10, 16 (smears positive), 18, 20, 23, 25, 28, 30, July 2, 5, 8, 10, 12, 14, 16 (smears negative), 19 (smear negative), 21, 24 (smear negative), 26 (smear negative), August 6 (smear positive) with smears negative August 13, 20, 27, 26 September 26 and November 6. On November 22 regular treatment was given and the smear was positive. November 24 diathermy was given and the smears were suspicious and again on December 1 when the smears were positive.

CASE 9 I B No 17810 Gonococci had been present since September 5, 1924. Regular treatments were given and positive smears found on September 5 and 17. Regular treatment was given on September 19. Diathermy was given and smears were found positive September 24 and 25. September 26 regular treatment was given and a slough from the cervix noted. September 27 regular treatment was given and slough smears gave positive culture. October 4 and 5 regular treatment with mercuriochrome was given and a slough was found healing.

Regular treatments were given October 8 and 9 (smear negative). October 16 diathermy was given and smears were positive. Regular treatment was given and smears were positive October 17. Diathermy was given October 18 (smears positive), 21 (smears negative), 22 and 23 (smears positive). November 1 regular treatment was given and the slough was marked. November 3 regular treatment was given, smear were found positive and the slough persisted. Diathermy was given November 5 (smears positive) and 7 (smears positive before negative after). November 17 smears were positive. November 19 smears were positive and regular treatment was given. Diathermy was given November 21 (smears positive), 24 (smears positive), 25, 26, 28 (smear suspicious), 29 (smears positive) and December 1. December 3 regular treatment was given and smears were positive. Diathermy was given December 4, 5 (smears negative), 9 (smears negative before positive after) and 10 (smears positive before and after).

CASE 10 C S 51805 Gonococci had been present since July 24, 1924. Smears were positive September 8 and 13. Diathermy was given and smear were positive on September 18, 20, 22, 23 (too much reaction for diathermy), 27, October 1, 4, 6, 9, 10, 22, 28, 29. Smears were found positive September 24, 26, 29, 30, October 7. Smears were negative after diathermy treatment on October 30 and after regular treatments on November 13, 14, 15, 17 and 18. Smears were positive after regular treatment on November 19, negative after diathermy on 22nd. Regular treatment was given on November 25 and diathermy on the 28th. Treatment was discontinued because of severe pain especially in an abdominal scar.

## A CRITIQUE ON THE HISTOGENESIS OF HETEROTOPIC ENDOMETRIAL PROLIFERATIONS

By M. R. ROBINSON, M.D., F.A.C.S., NEW YORK

OUR knowledge of heterotopic endometrial proliferations dates back to 1860 when von Recklinghausen first described adenomyoma as a pathological entity. For more than 30 years this subject lay dormant and only after von Recklinghausen published the results of his studies made in 1893, 1895 and 1896 did the pathological world evince an interest in this problem.

Since then a vast literature has accumulated but the origin and cause of endometrial growths still furnish a fertile field for speculative reasoning and academic discussions. With very few exceptions all those who have followed this path of research up to the present have agreed that all these tumors originate during the process of embryonic development from displaced rests of the genitourinary tract but they differed quite decidedly as to which of these anlagen whether the wolffian body and duct or the mucosa of the muellerian ducts constituted the exact histogenetic source.

As the result of this controversy two distinct schools have formed and their teachings still influence the concept of the histogenesis of adenomyoma. What are the bases for these theories?

### THE FUNDAMENTALS OF THE OLDER THEORIES

Accepting the dominant theory of displacement as a working hypothesis von Recklinghausen saw in the close anatomical relationship between the ducts of the primordial kidney and the generative organs sufficient ground for the possibilities of the transference of embryonal rests from one structure to the other. The muellerian duct (Fig. 1) lies to the outer side of the wolffian during the earliest period of embryonic development later on it assumes an anterior (Fig. 2) and still later a mesial position to the latter so that it may meet the opposite duct, fuse with it and thus form the fallopian tubes, the uter-

us and the vagina. In the schematic cross sections represented in Figures 3, 4 and 5 these typical changes are more clearly seen. In Figure 4 the primitive urinary and genital ducts lie in a fold of tissue known as the pleurogenitalis. These folds gradually approach each other in a mesial direction (Fig. 4) and as they extend caudally they finally unite in front of the pelvic cul-de-sac (Fig. 5) and form a common cord containing the wolffian ducts and the fused muellerian duct.

The crossing points of the muellerian over the wolffian ducts and their close anatomical relationship during the embryonic period constitute the keystone of von Recklinghausen's histogenetic theory. In addition to the embryological fact von Recklinghausen has further adduced microscopic evidences to prove that these organifications simulate the component parts of the mesonephros by presenting the following morphological arrangements: (a) narrow straight tubules lined with ciliated epithelium analogous to the collecting tubules; (b) secretory tubules; (c) ampullae; (d) end tubules; and (e) the fusion of many tubules to form main or principal canals. The stroma in which these tubules are embedded consists of a cytogenous connective tissue. Around the cystic glands the cytogenous tissue is scant and their epithelium rests immediately upon the muscle bundles. The glands which showed an irregularity of their lumina due to a bulging inward of part of the circumference were regarded as pseudoglomeruli.

In summing up his observations von Recklinghausen stated: "The epithelial constituents of the adenomyoma and cystadenomyoma of the fallopian tubes, of their interstitial portions and of the outer peripheral layers of the uterus are derived from rest of the wolffian body while the centrally located adenomyomata of the uterus arise from the uterine mucosa or its equivalent, the muellerian ducts."

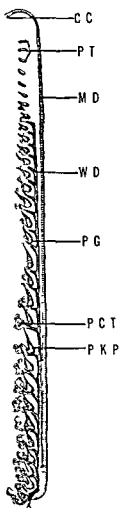


Fig. 1. Schematic drawing of the structural transformation of the intergenital organs of the female. CC Caudal cavity PT Primordial tubular tissue MD Mullerian duct WD Wolffian duct PG Paramesonephric gland PCT Paramesonephric canal PKP Paramesonephric kidney (After C. Rabi)

In 1897 Pick described his findings thus: "The arrangement of the glands in the organoid tumors resembles a goose step formation; they contain pigment bodies, pseudo-glomeruli, and collecting tubules in other words elements identical with those present in the mesonephros or pronephros. One year later he described the histogenesis of adenomata of the groin and of the posterior vaginal wall, and he showed an inclination toward a belief in a dual genesis, for he stated

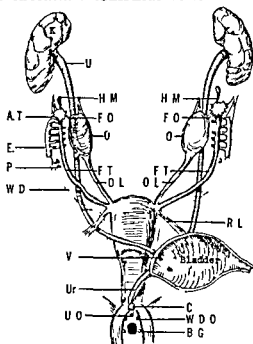
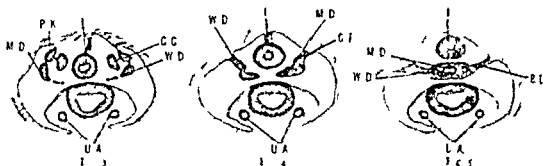


Fig. 2. A schematic drawing of the structural transformation of the intergenital organs of the female. U Uterus HM Hydatid Morgagni FO Fibria ovarica O Ovaries FT Fallian tubes OL Ovarian ligament AT Abdominal end of tube E Epooch P Paroophoron WD Wolffian duct DL Ductus ligament RL Round ligament V Vesicle of duct Ur Ureter UO Urethral opening C Clitoris WDO Wolffian duct opening BG Bartholin's glands (After H. K. C. Rabi)

The wolffian body and duct on one side and the muellerian duct on the other stand in such close developmental relationship to each other that we must ascribe the origin of the epithelium in the adenomata and cystadenomata to both sources. The adenomata containing ectogenous connective tissue are of muellerian origin for this type of tissue is found only in the uterine mucosa but thus far never in the wolffian body. Adenomata of the round ligament and of the posterior vaginal wall are of paroophoron origin and are due to displaced distal rests of the wolffian body. The cervical adenomata arise from Gaertner's ducts and must be differentiated from von Recklinghausen's paroophoric adenomata in the same way as adenomata of the seminal vesicles must be differentiated from tumors of the epididymis of the vasa aberrantia and of the organ of Giralde.



I have seen the Wolffian body in the Wolffian body. In 1903 he still championed the von Recklinghausen theory and stated: "It is true that the normal tubal mucosa has no glands, but the pathological tube is different; it can produce them." In 1909 in the report of a case of adenomyoma of the pelvic colon Robert Meyer propounded an additional hypothesis: a cuboidal hyaline elastic origin, namely the intestinal mucosa. This view he withdrew later on in favor of the serosa theory and also declared the Wolffian body theory to be a myth that is dying very slowly.

Although Robert Meyer ascribed to the serosal epithelium a wide genetic latitude, he did not adopt it as the common source of all endometrial growths as is implied in the following passage: "After all the most probable source of adenomatous growths is the uterine mucosa, but adenomata of the anterior vaginal wall and of the rectovaginal septum arise from Caertner's duct." In 1919 he relinquished the Caertner duct theory and extended the genetic phur of the serosa to the adenomyomata of the rectovaginal and the rectocervical spaces.

Fourteen years have passed since Robert Meyer prognosticated the death of the mesonephric theory and the end has not come as yet. On the contrary, it is being revived and rediscussed from time to time, and the serous

equilibrium theory has failed to take deep root.

In 1915 Lockyer was still adherent to the mesonephric teachings and cited Wiener who stated: "Since the round ligament sprang from the distal end of the kidney, passed the ovary, is the true ovarian ligament to reach the uterine end of the tube, and from hence became the round ligament of the uterus, it could carry with it separately portions of the Wolffian body, even if the distal parts in the depths of the mesovarium." It was more difficult to understand how the round ligament could incorporate glands to sue for the uterine canal or from the müllerian ducts. He further cited von Krauss for support of the müllerian view as follows: "Krauss's work stands out as an example of destructive criticism, but as a constructive effort it can not be said to have succeeded." In ramming von Recklinghausen's craft, he sank his own also. Lockyer's smile is metaphorically beautiful, but it will not save him from sinking the leaky boat upon which the Wolffian theory was embarked.

Cullen, the outstanding American authority on adenomyoma began the study of this subject contemporaneously with von Recklinghausen and from the very outset up to the present he has maintained unwaveringly that all adenomyomata arise from müllerian rests or from the uterine mucosa directly. He described his morphological findings thus:

The histological picture in a typical case of

adenomyoma of the uterus is very characteristic the uterine mucosa is often of a normal thickness and looks perfectly natural but as we approach the underlying diffuse myomatous tissue the mucosa is seen to penetrate it in all directions sometimes as an individual gland but often large areas of mucosa are seen extending into the depth. In favorable sections one can follow a prolongation of the mucosa half way through the uterine wall. Where the diffuse myomatous growth ends the outward extension of the gland also ends. In the course of time portions of the diffuse adenomyoma may project into the uterine cavity and be expelled through the cervix as a submucous adenomyoma. In other instances a portion of the growth is forced to the outer or peritoneal surface forming a subperitoneal tumor. Such a myoma is prone to become cystic and the cyst cavity or cavities will be filled with chocolate colored contents.

The above cited morphological picture is repeatedly reproduced in all of Cullen's prolific and meritorious studies made since 1896. In 1911 when commenting upon the histogenesis of adenomyoma of the umbilicus he said: "In the early embryo Mueller's duct is not far removed from the umbilicus; if one has found uterine mucosa at the hilum of the ovary in the round ligament and in the inguinal region I feel sure that some one will in the near future be able to explain to our satisfaction how the uterine glands reach the umbilicus."

It is thus evident that in spite of his painstaking studies and observations Cullen could not arrive at a definite conclusion regarding the histogenesis. In his very latest contribution of 1920 he still asseverates that the origin of all adenomyomata is the muellerian or uterine epithelium and leaves all incongruities which characterized this theory from its very inception *in statu quo*.

Kossmann in accepting the muellerian theory advanced the following reasons:

Every tissue that stands in structural relationship to the muellerian duct either as an accessory thereof or as a displaced group of uterine glands must and does assume the same form as soon as it comes under the in-

fluence of inflammatory or proliferative stimuli. Kossmann has thus sounded the first clear note in the histogenetic concept of adenomyoma.

Of the many other authorities who voiced the opinions of Cullen and Kossmann are Baldy and Longcope, Gott, Klages, Lockstaedt and Opitz. Additional citations would only mean futile reiteration; neither would the recital of more quotations from those who still uphold the mesonephric theory add in anyway to a better clearer or more definite understanding of the problem before us; hence we shall be content with the above review of the literature.

Recently the study of ovarian adenomyomata has undergone a notable academic revival through the meritorious work of Sampson. This author in attempting to fit in ovarian adenomata into the theoretic frame work of displacement postulated that these tumors are derived from the uterine mucosa which reached the ovarian surface through the fallopian tubes during menstruation. With all deference to Sampson's attainments these teachings excel any of the previous histogenetic theories in pathological casuistry and phantasy. Why must we assume that under normal conditions with a perfectly patent uterine and cervical canal the menstrual discharge will reverse its course and flow upward and force its way through the narrowest part of the tube in order to reach the ovary? His contention that the epithelium found in the tube lumen during menstruation is of endometrial origin because it bears a close structural resemblance to the latter is also not tenable for we know now that structural identity alone does not signify genetic proof. In order to substantiate the above claim it would be necessary to prove the absence of endometrial tissue in a previously ligated tube during menstruation; thus far no such experimental evidence has been furnished. We know also that the endosalpinx is capable of undergoing endometrial changes as was frequently observed in tubal pregnancy or in inflammatory or irritative conditions so that the presence of such tissue in the tube lumen does not have to be of direct uterine origin. Furthermore why must we believe



that the lifeless desquamated epithelium bathed in menstrual secretions which are lytic in nature as shown by O Frankl which are inimical to plant and slower life is proven by Schick and which contain various novars one of which menotoxin was recently isolated by Macht and Lubin why must we believe that such epithelium carried in this medium is capable of becoming grafted Stabler states that Sampson's claim for a retrograde flow of menstrual secretions in the presence of submucous polypoid myomata and retroflexion is thus far not proved Furthermore the epithelium that is desquamated during menstruation is no longer viable and therefore it is incapable of taking root anew In the face of these facts it is difficult to accept the theory of Sampson as a dependable working hypothesis

Synthesizing all these varied and contradictory theories and hypotheses we come to the conclusion that all investigators considered displacement as an essential factor in the process of endometrial proliferation but they did not agree upon the source of the displaced tissue The advocates of the mesonephric and the muellerian theories had at least an embryological peg upon which to hang their histogenetic claims and as long as the clinical observations were limited to the uterus and the fallopian tubes these teachings could retain a seemingly scientific standard But when clinicians and pathologists began to report the occurrence of endometrial structures outside the anatomical course of the primitive genital and urinary tracts then the deficiencies of the dogma of displacement became very apparent This is the reason why the problem of histogenesis has as many answers as there are questions in other words no correct or definite answer

Indeed what has prevented these keen observers from arriving at a unanimous opinion? Were their methods of investigation faulty? Is there really no common ground upon which those holding these views can meet? Is it possible to clear the path of research from the bleached bones of dead theories? This is the task undertaken in the present contribution

#### RECENT EMBRYOLOGICAL AND BIOLOGICAL FACTS BEARING UPON THE HISTOGENESIS OF ADENOMYOMA

The method dominating every histogenetic and pathological inquiry is the descriptive which aims at an accurate recording of the form shape and size of the individual cells and of the relation they bear to each other and to the stroma as a whole Its postulates morphological similarity proves genetic identity This idea caused the adherents of the mesonephric theory to adopt a primordial kidney origin because the arrangement of the glands in the adenomyoma seemed similar to those in the primitive organ and those who by ocular observation discerned an endometrial formation concluded that the genetic source was the uterine lining We cannot minimize the value of this method but we must bear in mind that it constitutes only one of the means by which a conclusion regarding the histogenesis may be reached To solve the structural origin of a tumor by morphological data only is as erroneous as to arrive at biological deductions from facts which are the result of cultural and environmental influences In fact one of the weakest links in Darwinism is the overemphasis laid upon the purely formative side of evolution We must also not forget that a fully formed cell such as we see in an adenomyoma or in other tumors is the product of genetic potentialities plus biological forces which came into play in the latter stages of ontogeny Histogenetic research must therefore antedate the period of cell differentiation

Ischer stated When we examine a tissue or an organ we find that its chief components the epithelium and the connective tissue present well defined and differentiated structural characteristics In the embryo however all epithelial cells arising from all the three germinal layers appear alike the same holds true of the embryonal connective tissue which consists entirely of the same cell throughout the body Somehow somewhere at the proper time and moment in the process of development genetic force harbored within the embryo become liberated and distributed to the individual cell groups of the germinal layers the latter respond to these

multi and begin to build up the tissues and organs they are destined to construct. What the forces leading to differentiation are we do not know as yet. Biologists call them determinants but we do know that for the unfolding of the genetic potentialities harbored within the cells certain biochemical or physiochemical conditions must arise within the embryo. We may hence assume justly that normal and abnormal growth are respectively the results of a balanced or a disproportionate play between the stimulating and the inhibitory genetic forces. We also know that the multipotency of the epithelium of the germinal layers is only partly used in the upbuilding of the body. The rest or excess of the epithelial cells remains permanently or temporarily quiescent depending upon whether the genetic forces remain potential or become kinetic. Besides the growth influences furnished by the embryo and the growth requisites supplied by the cells there is also an intercellular factor which strikingly affects the process of differentiation namely the structural and functional relationship between the covering epithelium and the underlying connective tissue.

Upon the biological phases of intercellular reciprocity Fischer expressed himself as follows. We may postulate it as a law in organic development that the epithelial elements play the dominant and leading role the connective tissue the subordinate or dependent part. The former becomes differentiated in a definite manner in the early stages of development into typical types for each organ the connective tissue portion on the other hand differentiates itself much later and the manner of its differentiation is dependent upon the formative influences which the overlying epithelium exerts upon it. The connective tissue dependence upon the epithelium continues throughout life during the embryonal state the dependence is formative and later on functional.

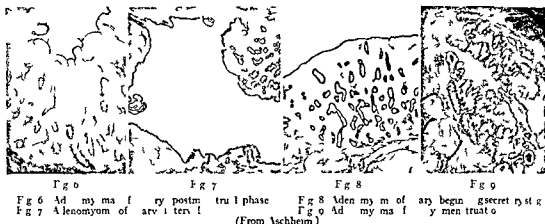
Another very pertinent biological fact in the study of histogenesis is the constant reciprocal relationship between genetic potentialities and genetic forces. We have stated before that the primitive epithelium is multipotent so that it can form any type of epi-

thelium but this property is enjoyed by it only up to the time of segregation when this apparently homogeneous mass of epithelial cells subdivides itself into definite cell groups each of which is destined to form a specific tissue or organ. The moment this division has taken place then the genetic potentialities inherent in and characteristic of each cell group unfold themselves and remain in variable properties of these cells throughout their entire existence. Furthermore these genetic potentialities respond structurally and functionally only to their own and peculiar genetic forces furnished by the embryo as a whole. Through the harmonious play between the intrinsic and the extrinsic cellular forces normal growth develops and function progresses.

Hence a conclusion regarding the histogenesis must be so comprehensive as to include not only proof of structural identities between the neoplasm and the tissue or organ of which it is claimed to be a derivative but also evidences of functional similarity.

#### THE MODERN CONCEPT OF THE HISTOGENESIS OF ADENOMYOMA

Although unable to explain satisfactorily how the muellerian rests have reached many of the adenomyomatous sites Cullen and his school were nevertheless right in their steadfast adherence to their theory for they have always observed that the adenoid growths in the tumors bore not only a structural resemblance to the endometrium but that they also simulated the uterine mucosa functionally. The followers of the mesonephric theory could claim at best only formative resemblances but at no time were they able to prove functional processes in the adenomatous tumors which equaled those of the fully developed kidney. One of Robert Meyer's very latest statements that the ovarian hormones may also influence primordial kidney rests to endometrial proliferation must be accepted very guardedly and dubiously. This supposition is most likely founded upon the multipotency and structural homogeneity of the calomic epithelium out of which both the genital and the urinary organs are derived. This is however not a valid reason for the



admission of promiscuity between genetic potentialities and genetic forces

The fact that we cannot as yet distinguish by the means at our command between the very earliest anlagen of the apparently uni-form coelomic epithelium does not warrant the assumption that cells destined to form genital organs can and will respond to stimuli prepared for the activation of urinary rudiments and vice versa. According to Corning

We are still unable with the means at our disposal to detect sex differentiations before the embryo has reached the length of 18 to 20 millimeters; this does not imply however that no sex differences exist before this time and we have no right to call this period the indifferent state. On the contrary it is becoming more probable that sex determination develops early in the ovular period.

What is true of sex determination is and must be equally true of genetic potentialities which are present in the cell long before microscopy can reveal them and of the genetic forces the mutual action and reaction of which are subject to well defined and invariable natural laws. The clinical and microscopical evidences furnished by the study of adenomyomatous tumors bear undeniable testimony to the scientific claims embodied in the above biological axioms. Lauche has correlated these scientific truths to the clinical facts in his latest monumental contribution the basic principles of which are the following: (1) Adenomyoma: a neoplasm peculiar to the female. (2) The epithelium lining the

glands responds formatively and functionally to the ovarian hormones in the same manner as does the endometrium. (3) This reaction occurs in the tumor and in the uterine mucosa simultaneously. (4) The hormonal response is greatest during the height of sexual activity.

I shall now demonstrate these facts by a series of photomicrographs of an ovarian adenomyoma. In Figures 6, 7, 8 and 9 are represented respectively the postmenstrual, the interval, the beginning secretory and the menstrual phases and were it not for the fact that ovarian stroma surrounds these gland spaces no pathologist could differentiate the morphological changes from those taking place in the endometrium proper. To be true to the biological axiom that genetic evidence rests upon functional as well as upon structural similitude a section of ovarian adenomyoma in the postmenstrual phase was stained for glycogen and the glycogen appeared bright red exactly as it would have looked in a section taken from the endometrium itself (Fig 10). Of the other morphological changes which take place in the heterotopic endometrial structures is a decidual reaction. Williams and others have observed it in gravid adenomyomatous uteri. I have observed decidual reactions in the tubal mucosa in cases of intra uterine and extra uterine gestation as well as decidual reactions of the serosa of the appendix. The pertinent facts adduced from this demonstration prove that there is a structural and a functional identity between heterotopic endometrial prolifera-

tions in the ovary and the uterine mucosa hence both must have a common genetic source and must be influenced by the same hormone or hormones. The same applies to all types of adenomyoma.

What is this common genetic soil from which spring all endometrial growths? Since the coelomic epithelium is the structural source of the generative organs any morphological phenomenon arising within the body during adult life which simulates the uterus structurally and functionally must of necessity be a derivative of the same embryological rudiment. What really takes place in the evolution of an extra uterine endometrial growth is a topical awakening of the genetic potentialities in some of the unused coelomic rests through a sudden increase of the stimulating or through a diminution of the inhibitory genetic forces. With this explanation the difficulties presented by the theory of displacement are at once removed and since it is not necessary for endometrial or endosalpingial parts to be actually transported to different regions in the body to act so to speak as adenomyomatous seeds the terminology of displacement must be discarded. In its stead Robert Meyer proposed the terms heterology or heteroplasia of the peritoneal epithelium. The same process of reasoning is applicable to the cytogenous tissue present in the adenomatous tumors which was considered by the adherents of the theory of displacement as positive proof of endometrial transportation since this tissue is not found anywhere else in the body except in the uterus. This however is not the true condition. If we recollect the biological principle that the overlying epithelium exerts a definite formative and functional influence upon the supporting connective tissue stroma then the finding of cytogenous tissue around the glandular spaces is but a normal and natural sequence. And just as the coelomic epithelium is capable of heterotopic endometrial proliferation without having to be displaced from the primitive (or fully developed) urinary or genital tracts so can and does the connective tissue in the vicinity of these glands undergo cytogenous metamorphosis identical with that of the uterus without the process of displacement.

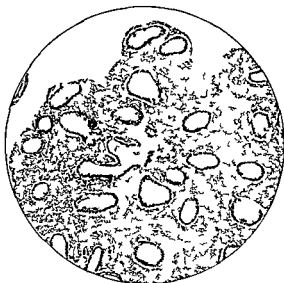


Fig 10. Adenomyoma of ovary postmenstrual phase glycogen deposits (Aschheim)

The following demonstration elucidates these facts very succinctly.

In Figures 11, 12, 13, and 14 are reproduced respectively sections of adenomyomata from the intestinal wall, the round ligament, the umbilicus and a laparotomy scar and each shows that wherever the lining epithelium is high and columnar i.e. active its underlying connective tissue also bespeaks function as evidenced by the increase in the number and size of its cells. On the other hand those portions of the gland circumference bearing a low cuboidal epithelium present a correspondingly inactive connective tissue. These photomicrographs also emphasize once more the illusiveness of morphological facts alone as criteria for histogenetic conclusions. How could the propounders of the older histogenetic theories claim different genetic sources for the differently located adenomyomata from their histological studies only when there are no structural differences between the various adenomyomatous growths. Were it not for the fact that the sources from which these different sections were obtained are known no pathologist could tell from a microscopic examination their organic derivation. The heterotopic character of adenomyomata in no way militates against their homogeneous



Fig. 14. Adenomyoma of the uterus (Lauh)

morphology and functional responses to proper and specific activator; hence all adenomyomata have the same genetic soil.

#### THE CLINICAL VERIFICATION OF THE BIOLOGICAL AND EMBRYOLOGICAL PRINCIPLES

The keystone of the histogenetic arch is the structural and functional similarity between the neoplasm and the soil of its derivation. Of all the tissue in the female organism the coelomic epithelium is unique in possessing adenomyomatous anlagen. To complete our histogenetic equation we must add to the already known factors genetic potentialities and genetic forces; the anatomic proof that coelomic epithelium or its later modifications into peritoneum or mucosa is present in the location indicated in Figure 15 as the adenomyomatous centers.

Uterine and tubal adenomyomata, in which the anatomic continuity between the endometrium or the endosalpinx and the neoplasm is traceable, present no histogenetic problem. The adenomyomata occupying the outer uterine zones or situated subperitoneally are derived from the covering serosa, a definite adenomatous source.

Ovarian endometrial growths arise from the covering germinal epithelium, and while this tissue also serves as a genetic source for other tumors, it manifests the adenomyomatous proclivity under certain and propitious conditions only. Inflammation may



Fig. 15. Leiomyoma of the uterus (Lauh)

at times act as an exciting cause. At times the adenomyoma of the ovary may be a prolongation from a similar growth in the uterine wall. Whichever may be the case, the coelomic epithelium is biologically the starting point.

Round ligament adenomyomata, whether of the intra- or extra-abdominal portions, take their origin from the peritoneal reflection which accompanies it throughout its course, at times even as far as the labia majora.

Umbilical adenomyomata also originate from coelomic rests, the exocoelom which accompanies the urachus, the allantois, and the umbilical blood vessels, as they make their exit through the umbilical ring.

Laparotomy scar adenomyomata may develop after operation in which the genital did not enter into the operative scope; this fact has been proved clinically. The genetic source is the injured parietal peritoneum.

All the other organs and tissue in which adenomyomata have developed have as one of their anatomic constituents either a covering, or a lining, which in the broad embryological sense is the same, hence a potential adenomyomatous source.

We have now earned our histogenetic concept to its final logical and scientific conclusion. We have proved that all adenomyomata are alike in structure and function, that they all respond to the same stimulating or inhibitory somatic forces, and that they all

## ROBINSON HETEROTOPIC ENDOMETRIAL PROLIFERATIONS

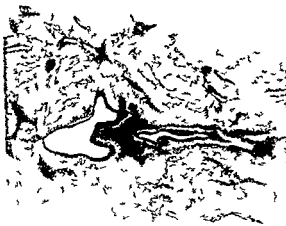


Fig 13 Adenomyoma of umbilicus (Lauche)

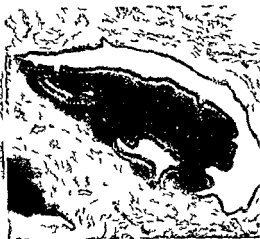


Fig 4 Adenomyoma in a laparoscopic myometrium (La

possess ectopic rudiments hence the basis for a heterotopic endometrial proliferation. We may now proceed to the next question and ask what is the cause of adenomyoma?

### ETIOLOGY

For the tubal adenomyomata Chiari accepted an inflammatory cause. In my study of the pathogenesis of adenomyosalpingitis published in 1913, I have arrived at a similar conclusion. The bases for the inflammatory theory were (a) the associated subacute or chronic salpingitis of a neisserian or tuberculous nature and (b) the seemingly identical intritubal and intraglandular contents. Robert Meyer and von Fränke also laid stress upon inflammation as the etiological factor in the development of pelvic adenomyomata. In the causation of Sampson's cases we also find clinical data pointing to a associated pelvic inflammation. These were the reasons why Robert Meyer and also von Fränke questioned whether adenomyomata should be included in the category of tumors. They were of the opinion that these neoplasms were mixed tumors consisting of myomata with inclusions of hyperplastically inflamed glands hence the term adenomyositis. In support of this view the above quoted authorities cited the clinical observation that the tumors diminish in size or disappear at times with the subsidence of the inflammation.

Notwithstanding these opinions and observations it is my conviction that while in

inflammation may act as the primary in some cases and sets the ectopic rest the proliferative swing it is not the cause dominating the further development of these tumors.

No matter how inflammation may define the three cardinal phases postulated by Lubarsch alteration, exudation, inhibition and proliferation will always constitute a tissue response characterizing a tissue response to microbial or foreign invasion. At least these phases must be present in a tissue action before we may term it inflammatory. Are these reactions present in the myomatous growth *per se*?

After examining many sections of myomatous tissue and also some of those designated as adenomyositis I could not find the true inflammatory changes. The prominent morphological phase in these tumors is the proliferative association with a lymphocytic infiltration, leucocytosis, no cell destruction and reparative replacement by connective tissue. In looking backward upon the criteria we have accepted as indicating that adenomyositis was a direct inflammatory process I am constrained to state that these must now be changed. The adenomyoma of the tubal wall as such did not show inflammatory reactions. Regarding the glandular contents which resembled those of the uterine cavity or of the proper and were therefore accepted

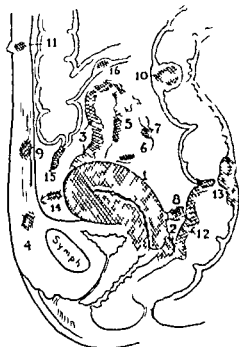


Fig. 5. Schematic drawing of the testis which in many respects is similar to the female reproductive system. The testis is shown in a longitudinal section, with the epididymis and vas deferens. The diagram is labeled with numbers 1 through 16, corresponding to the anatomical structures shown in the main figure. (After Cull)

evidence of a direct transportation of tubal mucosa into the depth of the tubal wall we can now interpret the phenomenon as simultaneous biological processes. Furthermore, if we analyze carefully the intratubal contents in adenomyosalpingitis in uterine adenomyomatosis or in ovarian adenomyomatosis we will find pigment red blood cell proliferation and degeneration of the columnar epithelium and various degrees of round cell infiltration. In what way may it be that the morphological changes differ from those observed in the premenstrual or pregravid endometrium? Aschoff's subdivision of inflammation into defensive and protective types may serve our purpose very well. The reaction taking place in the endometrium of a gravid uterus may be considered as protective for the implanted ovum while the result of a biological

process is nevertheless a foreign body to the female organism as a whole. The adenomyomatous tumor by their alteration in size premenstrually and postmenstrually and by the microscopical and biochemical change noted within them during the different phases of the menstrual cycle and during gravidity speak loudly for biological metamorphosis rather than for inflammatory processes. In view of the fact we have to consider bacterial inflammation as a possible initiative but not as the ultimate cause of endometrial proliferation. The cause of adenomyomatous growth in excess of ovarian hormones which under given biological conditions exert a proliferative influence upon the dormant calcemic rests to adenoid formation. The latter respond to the hormone in a functional way as well as expressed clinically by menorrhagia and metrorrhagia by the formation of fatty cysts in the ovaries and by the periodic enlargement and shrinkage of the adenomata at the beginning and at the end of each menstrual period.

### CONCLUSIONS

1. Histogenetic investigation must antedate the period of cell differentiation.
2. Morphological similarity is not synonymous with histogenetic identity.
3. Histogenetic proof demands functional as well as structural similarity between the neoplasm and the tissue or the organ of which it is claimed to be a derivative.
4. The theory of displacement no longer fulfills our present concept of heterotopic endometrial formations; it should be discarded.
5. Adenomyomatosis peculiar to the female and prevalent during the period of maximum procreative function.
6. The calcemic epithelium harbors adenomyomatous potentialities which it unfolds when acted upon at the proper time and moment by specific genetic force furnished by the body as a whole.
7. The columnar epithelium is capable of exerting cytogenic influence upon its supporting connective tissue.
8. The genetic source of all adenomyomatosis irrespective of location is the calcemic epithelium.

9 Inflammation may precipitate an adenomatous process but it cannot enhance its growth and development the latter being the result of biological or biochemical processes

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## HÆMANGIOMATA OF THE BLADDER AND URETER

By JOHN ROBERTS CAULK M.D. F.A.C.S. ST. LOUIS, MISSOURI

**T**UMORS of vascular origin of the bladder and ureters are so rare that the following cases seem worthy of report. The first case was a telangiectatic hæmangioma of the bladder wall the other a pulsating cavernous hæmangioma of the ureter simulating inoperable carcinoma of the bladder. I group these two cases since the angoma of the ureter made its impression beneath the mucous membrane of the bladder in two places eroding it with the production of hæmorrhage so that at first it gave every appearance of a vesical growth.

**CASE 1.** Male age 35 consulted me in April 1918 complaining of the passage of blood in urine. The past history is entirely negative except that he had gonorrhœa as a young man but no history of lues. There had been no history of birth defects in his family and he had never been seriously ill. Patient has been perfectly healthy until 6 weeks before admission when without premonition he began passing blood in the urine. He described the blood as being entirely mixed with the urine and having the appearance of dark wine. The bleeding had been constant during this period but on several occasions had been less profuse. There had been absolutely no other urinary disturbances no history of pain in kidney regions nor any reflected pains in back or legs. Sexual powers were normal. He had not lost weight but patient felt he was a little weak from loss of blood.

Examination revealed a healthy looking man somewhat pale. General examination was entirely negative. No abdominal masses were present. The external genitalia were normal. The urine passed in 2 glasses was dark brown in each. Microscopically it contained blood but no infection was found. Rectal examination showed the sphincter tone good. The prostate was normal in every way. On making a cystoscopic examination the cystoscope entered easily. The bladder was easily washed clean. On casual inspection it seemed to be entirely normal. The ureteral orifices were normal and clear urine was seen coming from each. After a careful search there was observed on the left lateral wall of the bladder approaching the sphincter margin a very small pale red dilatation of blood vessels in the center of which was a pinpoint bluish elevation from which was issuing a constant fine stream of blood. The bladder wall in the vicinity of this growth was entirely normal. The tumor had the appearance of an ordinary nodule. Diagnosis Hæmangioma.

**Treatment.** The tumor was burned with high frequency current and completely destroyed. Patient was cystoscoped a week later and at the site of burning there was a small ulcer. At the end of a month the ulcer had entirely healed leaving no evidence of the previous tumor. Patient has remained well.

**CASE 2.** Woman age 60 consulted me in October 1923 complaining of passage of blood in the urine. The past history is entirely negative except for an attack of bleeding. Five years ago patient passed a little blood at the end of urination. This lasted for one or two voidings subsided and did not recur until weeks ago. In the meantime there has been absolutely nothing to concern her. Two weeks ago without cause she began passing blood in the urine. Blood has been bright and usually appears at the end of urination. The urine has never been dark and she has never passed clots no frequency difficulty or pain on urination no pains in back legs or history of renal colic no fever chills or loss of weight but she has been very nervous. The day before I saw her she had consulted a gynecologist who found upon making a vaginal examination that there was a very hard indurated area on the vault of the vagina corresponding to the base of the bladder in the region of the trigone situated a little to the right of the median line. This mass was about 1 inch to 1 1/4 inches in length and about 3/4 of an inch in breadth. The same physician had sent me a patient a year previously with as he said the identical palpable findings and the mass proved to be due to an infiltrating squamous celled carcinoma of the bladder wall.

Examination revealed a stout healthy looking woman. The general examination was entirely negative. Upon vaginal examination I felt an indurated mass which was exactly similar to that in the case above alluded to which proved to be cancer. The mass was very hard very fixed but not sensitive.

Cystoscopic examination showed the bladder capacity normal. The urine was slightly tinged with blood. Upon examining the bladder there was observed a peculiar condition of the left lateral wall and base starting from the left ureteral orifice and running outward and upward. The bladder wall gave the appearance of rigidity. The mucous membrane was quite smooth over this area which had a peculiar mottled appearance consisting of areas of blue and almost black spots intermingled with lighter cystic looking masses between which there were light corrugations. This area seemed about 1 inch in length and about 3/4 inch in diameter and corresponded exactly to the size of the vaginal induration. At the outer edge of this mass there was a

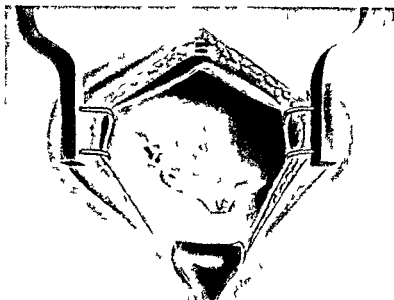


Fig. App. m. c. f. g. m. of the bladder

typical telangiectatic spider web dilatation of the vessels. In the center of the thickened area there were a few spots with adherent small blood clot. The striking feature of this whole area was its position on the bladder cavity. Catheters were passed up the ureters and they were both perfectly free and the urine from the kidneys was clear. With the finger in the vaginal pressure on this indurated area elevated the bladder growth. No pulsation could be felt through the vagina.

My associate Dr. Sanford and I were both struck with the marked pulsation of the tumor and this coupled with the telangiectatic area at the upper part made us feel that the tumor was very vascular and most probably a hemangioma but because of the rigid appearance of the bladder wall the infiltration of the vaginal vault and associated hematuria caused me to believe the bladder with extension seemed inevitable.

On November 30, 1923 I did a suprapubic cystotomy. Upon freeing the right side of the bladder down to the ault of the vagina I felt a very hard stone-like mass binding the bladder and the vaginal vault together. After exposing this mass I was able to dissect it out quite nicely and it proved to be a large calcified lymph gland, the ring of the obstructed ureter. It was located at the junction of the ureter. After removing the gland the vaginal vault felt perfectly soft. The bladder was opened freely and the area which had been obstructed by the tumor was seen. There was no hardness in the mucous membrane, it was perfectly smooth. With palpation, growths on the outer side of the bladder and the

thumb with its cavity there was felt between them an elliptical mass about the size of a large pecan quite movable having a rubbery feel. Upon delicate pressure it could be felt to pulsate. The posterior wall was opened with a incision running from the tip of the tongue upward and outward external to the outer margin of this mottled area of mucous membrane. Upon incising the mucous membrane a mass which was quite irregular, firm and elastic presented itself. It was easily separated from the mucous membrane of the bladder which it had partially eroded in one spot, this being the spot to which the blood clot was adherent upon previous cystoscopic examination. On further study it was found that the growth had completely encircled the ureter which was passed for at least 2 inches from its junction to the bladder. The mass was quite encapsulated and under the surrounding fascia could be seen the irregular conglomerate masses of vascular dilatations. The tumor was situated on its interior surface about the ureter until the wall of the ureter was exposed and grew on its side with clasp and completely freed from the wall of the ureter. It was adherent in several places to the adventitia. The chief attachment was to the lower part of the ureter entered the mucous membrane of the bladder. Here it was as vessel the size of a small match which was ligated and the tumor removed, leaving the ureter intact. It had not contracted the ureter or produced a voidance of obstruction. After the removal of the growth there was no voidance of palpable mass in the bladder wall. The mucous membrane over the growth was excised the posterior wall of the bladder



Fig 2 (Left) Angioma surrounding ureter posterior wall of bladder opened  
Fig 2 (Right) Angioma surrounding ureter posterior wall of bladder opened

was sutured the bladder closed as usual around a tube drainage a cigarette drain was placed in the space of Retzius and another in the lateral cavity in the neighborhood of the ureteral portion.

Patient made satisfactory recovery and entirely well. Cystoscopic examination 3 months after operation shows no sign of bladder wall involvement bladder being entirely healed and normal in appearance.

Pathological examination showed the tumor to be rather firm and opened out as it was between two clamps and it measured about 1 inch in length and about 1 inch in width and 1/2 inch in thickness. On section it was seen to be composed of large dilated spaces filled with blood clots between which there was a definite mass of fibrous tissue. Some of the spaces were quite large. Microscopically the tumor seemed sharply circumscribed composed of large irregular spaces filled with blood lined with endothelium between which there was a fibrous tissue stroma and numerous smooth muscle fibers. One artery of considerable size seen in cross section. It shows extensive calcification and thickening of its wall a pronounced intimal arteriosclerosis. A small portion of the bladder wall which was removed with the tumor is normal except that it shows extravasation of blood between the muscle bundles. There are several areas of pigmented deposit apparently the result of previous extravasation. Pathological diagnosis. Characteristic hæmangioma of the cavernous type.

Hæmangiomas of the bladder are extremely rare. The first observation of such a tumor

in the bladder was by Gross in *Treatise of the Urinary Organs* 1851. The patient was a woman 72 years of age who suffered from hæmaturia. A soft irregular cauliflower tumor was found at autopsy but no histological description was given.

The first authentic tumor of this type was described by Albarran in 1892 in a man 64 years old who had suffered from hæmaturia. He died at operation performed by Guyon. Microscopic examination showed capillary dilatation surrounded by connective tissue. The tumor was submucosal and bladder epithelium was well preserved.

In 1909 Robert Bryan of Richmond reported a typical cavernous angioma which he removed by suprapubic cystotomy. At this time he remarked that he had been able to find no reference to such a growth in the bladder except by Albarran. *Tumeurs de la vessie* Paris 1891. Langhans in Virchow's *Archiv* 1879 lxxv 291.

Judd and Harrington in *Tumors of the Urinary Bladder* report a case of large polypoid tumor filling a greatly hypertrophied bladder extending through the bladder wall into the right extravasical space with a growth as large as a grapefruit.

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Launay Achard and Carniere<sup>1</sup> reported a large angioma the size of an orange removed from the posterior and right lateral wall of the bladder by partial cystectomy from a patient who had complained of frequent painful urination with hæmaturia and pain in the right iliac fossa. Diagnosis was appendicitis and the operation was performed for this condition. The tumor was composed of large dilated blood spaces filled with clots surrounded by connective tissue.

Thomas described a small angioma of the bladder cured by fulguration which was similar to my first case above described. Lane reports a cavernous angioma of enormous size in a child 3 years of age. Jungano observed a massive cauliflower angioma of the trigone undergoing sarcomatous degeneration. The most recent report of this rare bladder condition is by Frank Kidd<sup>2</sup> of London. He reports a polypoid pedunculated tumor attached to the anterior wall of the internal meatus projecting into the bladder in a patient who had suffered from acute retention of urine with severe cystitis but only slight hæmaturia which followed catheterization in one or two instances. The tumor he described as looking like a raspberry was removed by suprapubic cystotomy and was found to be composed of a central core of muscle similar to that of the bladder covered by bladder epithelium. This central core of the muscle contained large and numerous blood vessels which on section proved to be

angiomatous. He designated his tumor as angiomoma.

Scholl<sup>3</sup> speaks of the rarity of angiomata of the bladder. These tumors may be small and have as their only symptom a persistent profuse hæmaturia or they may be extensive and penetrate into the prevesical tissues, imitating growths of other pelvic organs. Watson found but two angiomata in 653 collected tumors. It is therefore evident that hæmangiomata of the bladder are very rare tumors which have as their usual symptom hæmaturia which has a tendency to be constant and unless the tumor involves the bladder outlet or attains an enormous size hæmaturia may be the only symptom.

After a careful search through the literature I have been unable to find a single report of a hæmangioma of the ureter. It seems therefore that my second case is unique. The striking feature of the tumor in this case was its pulsation. I have seen no mention of pulsation in any of the other tumors. The pulsation in this tumor was indeed pronounced. It would seem from the structure of the growths that such a finding should be common but it depends of course on the relation to the artery. The explanation of the terminal bleeding in this tumor is that at the expulsive effort at the end of urination the bladder contracted against the vascular mass between its walls and the mucous membrane had thus begun to be eroded. The case is of great clinical interest because it so simulated an infiltrating cancer of the bladder wall.

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POSTOPERATIVE MASSIVE COLLAPSE OF THE LUNG<sup>1</sup>

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A CRITICAL study of the literature on the subject of postoperative pulmonary complications discloses the fact that their incidence has not diminished. Statistical studies of Norris, Pepper, McKesson, Cutler, and Hunt place the incidence of morbidity caused by pulmonary postoperative complications at from 2 to 4 per cent and the mortality from the same cause at about 0.6 per cent. This incidence has not been decreased by the use of local anesthesia.

One is also impressed with the radical change in our conception regarding the nature of these lesions and their mode of production. Such terms as aspiration pneumonia or ether pneumonia have been to a great extent discredited. The newer conception teaches that all postoperative lung lesions are caused by the transfer of small particles either sterile or infected from the field of operation to the lung tissue. In other words, we are here dealing with embolisms and infarctions.

Among these well known and well understood complications the so called massive collapse of the lung is a new or at any rate judged by the scarcity of the reported cases a rare condition.

Its recognition nevertheless is a matter of considerable importance to the patient both from the therapeutic and prognostic viewpoints. The physical and roentgenological signs of this condition are so striking and so characteristic as to make its recognition relatively easy provided the examiner is familiar with the picture.

It is not my intention to review the literature since this has already been done by others, notably by W. Lee (1). I shall be content here to sketch briefly the development of our knowledge of the subject.

William Pasteur (2), an English physician, first recognized and described in 1890 what he had termed massive collapse of the lung.

His first observations dealt with cases of postdiphtheritic paralysis. He diagnosed the

condition in 34 patients and had the opportunity to verify the diagnosis in several cases which came to postmortem. Applying his knowledge thus gained to the study of postoperative material at the Middlesex Hospital, Pasteur found 12 cases of massive collapse of the lung out of a total of 61 lung complications.

Important contributions to the subject were made by Sir John Rose Bradford (3) during the late war. He had seen this condition most frequently as a complication in injuries to the chest. It sometimes followed most trivial non-penetrating wounds of the thorax, also of the buttocks, the pelvis, or the thigh. He made the interesting observation that not infrequently the collapse took place on the uninjured side of the chest, a condition which he called contralateral collapse. He believes with Pasteur that the *modus operandi* of this condition is a reflex nervous phenomenon.

In civil practice the condition is seen most often after abdominal operations. The time of onset may be as early as a few hours or as late as 7 days. It may be ushered in suddenly and may suggest a catastrophe of a serious nature, such as a coronary embolism, huge pulmonary infarction, or acute dilatation of the heart. Far more commonly, however, the onset is rather insidious. There is noted a moderate rise in temperature, the pulse is only moderately accelerated, the respirations are seldom above 30. The patient exhibits but a mild degree of discomfort and the dyspnea is not at all marked. There is very little cough, the patient frequently complaining of his inability to cough it up. A very small amount of mucopurulent stuff is brought up with great difficulty.

The physical signs are most characteristic. I feel that I could do no better than to quote verbatim from the classical description of Rose Bradford. The cardiac impulse is greatly displaced toward the affected side, the

displacement is lateral and upward the lateral displacement being usually far the greater. If the left be the affected side the apex beat may be found in the axilla if the right the impulse may be felt in the right nipple line. There is often marked displacement of the impulse upward and it may be palpable as high as the third rib. The affected side of the chest is retracted and immobile and the ribs can be seen and also felt to be closer together than on the normal side. The high level of the diaphragm can be readily demonstrated on the left side by percussion; this method is not so satisfactory on the right side but X-ray observation not only demonstrates the high level of the diaphragm but also reveals its immobility on the affected side. The percussion note is impaired all over the affected side and dullness marked in amount may be present up to the level of the clavicle. In the left axilla because of the altered position of the diaphragm resonance to an abnormally high level is present. Tactile vocal fremitus is either diminished, absent or increased. If diminished or absent the breath sounds are also diminished or absent; if increased the breath sounds are tubular or amphoric in character. In such cases bronchophony and pectoriloquy are exceedingly well marked. Thus two groups of cases may be recognized: one with diminished or absent tactile fremitus and breath sounds and one with increased tactile fremitus together with tubular or amphoric breathing and with bronchophony and pectoriloquy. The difference depends upon the relative patency of the bronchial tubes. In both cases extreme displacement of the heart is present.

The physical signs may be summarized by saying that the pulmonary signs present a considerable resemblance to the well known signs of consolidation if anything they are rather more marked especially in the tubular or amphoric character of the breath sounds; these signs are however accompanied with retraction and immobility of the chest wall together with displacement of the heart and of the dome of the diaphragm. These characteristic signs sharply differentiate cases of massive collapse from other pulmonary lesions and from pleural lesions.

Several theories have been brought forward to explain the mechanism of the collapse. Pasteur and Bradford incline to the neurogenic origin. Pasteur's postdiphtheritic cases undoubtedly were examples of paralysis of the diaphragm due to the lesion of the phrenic nerve. Bradford's cases of contralateral massive collapse certainly strongly point to a reflex nervous mechanism.

A number of observers believe that bronchial obstruction is the essential factor. Assuming that in postoperative cases there is a limitation of pulmonary expansion and retraction one can readily see that mucus is formed and is not expelled causes an obstacle to the ingress of air into the smaller bronchioles and leads to ultimate alveolar absorption of the air into the circulation. The only experimental work offered in support of this theory is that done by Lichtheim in 1878. He introduced laminaria plugs into the bronchi of rabbits. Collapse of the lung tributary to the bronchus took place. The theory of bronchial obstruction fails to explain the cases of contralateral collapse as Sir Bradford remarks there must be other factors operating the nature of which is not recognized.

Prognosis of this condition is very good; very few fatal cases were reported. The lung becomes completely reinflated in about 10 days. Occasionally re-inflation is delayed for 3 or 4 weeks. On the other hand restitution sometimes takes place in a surprisingly short time.

#### CASE REPORT

Mr. J. P. admitted to the private service of Dr. H. M. Rechte at the Wesley Memorial Hospital November 3, 1924. The patient was male, 33 years old, very muscular and apparently in vigorous health. His case had been studied prior to his entry by several competent internists and X-ray examinations had been made on two separate occasions. Physical and roentgenological examination were entirely negative so far as the chest was concerned. His case was diagnosed as one of chronic cholecystitis. He was operated on the morning of November 4 (by H. M. R.). He had received one dose of morphine grains and scopolamine grains 1/15 1/2 hours before the operation and another hour later. An attempt was made to operate under gas anesthesia aided by local infiltration with novocaine. The patient normal at solution. Because of muscular rigidity, ether had to be resorted



Fig. 1. Roentgenogram of patient taken November 7 showing massive collapse of the right lung.



Fig. 2. Roentgenogram of patient taken November 7 showing normal lungs.

to. The usual gall bladder incision was made and a frankly pathological gall bladder was removed. The appendix was removed through a separate muscle splitting incision. The amount of ether used was 8 ounces; the duration of the operation 55 minutes.

The next day the patient was somewhat restless; the afternoon temperature reached 100.6 degrees F and the pulse 66. He complained of tightness across the chest. He was very restless that evening and coughed occasionally during the night. At 7 a.m. the following morning the nurse recorded that his respirations were shallow and apical 36 to a minute; his pulse was 120 and temperature 102.2 degrees F. He looked anxious and sick; the alar nasi were working. Examination revealed dulness over the right lobe. The breathing was very quiet, hardly audible. A bronchial consolidation was suspected.

November 7. The lowest temperature was 99.8 degrees F and the highest in the evening was 100.6; the pulse varied between 90 and 120 respirations 24 to 32. The following notes were made. Examination revealed a very striking hyperresonance over the cardiac area. Cardiac dulness has shifted markedly to the right. The apex beat is difficult to feel but as nearly as can be made out is about 4 centimeters inside the mammary line. In other words, the heart is retracted toward the right. The right side of the chest is immobile and retracted. It is resonant to percussion; the breath sounds however are markedly suppressed. Transmission of the spoken voice is somewhat exaggerated. The

left side is hyperresonant throughout. The condition warrants the diagnosis of massive collapse of the right lung.

The patient coughed occasionally and brought up with great difficulty a very small quantity of grayish mucopus. He exhibited very little dyspnea except when he was turned on the affected side. This resulted in a most urgent dyspnea and a fit of coughing.

November 8. The condition was unchanged except that the left border of the heart was now at the mid sternal line. Roentgenological studies (Fig. 1) revealed the following. The left thorax was clear. It was noted that that portion of the heart which usually lies to the left of the median line had entered the right thorax. The right lung field was almost entirely obliterated with the exception of the small amount of aerated lung in the upper right periphery. The lower portion of the lung was occupied by a diffuse density. The heart and aorta lay in extreme dextrocardia.

The patient improved every day so that on November 10 he was afebrile, the pulse was 88 and respirations 22. Examination of the chest on November 7 revealed a normal condition of both lungs and of the heart. X-ray films (Fig. 2) taken the same day showed a perfectly normal condition. Both lungs nearly filled the thoracic cavity. Both pulmonary fields were of approximately normal transparency. The heart and aorta likewise were seen to be normal and there was no evidence of a pleural lesion.



## CONCLUSIONS

1 Postoperative massive collapse of the lung is a well recognized condition

It occurs most frequently after abdominal operations

3 The cardiac displacement toward the affected side is its most characteristic physical sign

4 It would at least be logical with the view of preventing shallow breathing to carry out systematic breathing exercise in all postoperative cases and to abandon the

method of fixing the dressings after laparotomies by tightly strapping the abdomen and the lower half of the chest with adhesive strip

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## AIDS IN PREDICTING THE DEGREE OF POSTOPERATIVE THYROID REACTION

A STUDY BASED ON 1 000 CONSECUTIVE CASES

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From the Larynx Clinic

IN operations on patients with thyroid toxæmia one of the great difficulties which confronts the surgeon is the reaction of the patient to operation. This postoperative reaction varies considerably in type and extent but it always carries the threat of death.

A good deal can be done when once these reactions have started but if they are of sufficient intensity or if the patient's resistance is unduly low, death may ensue in spite of all that can be done. Prophylaxis is better than therapeutics. A more certain method than the care of the reaction after it has started is to prevent its occurrence or to lessen its severity. This can be done by adapting the operation to the condition of the patient.

If a thyroidectomy or hemithyroidectomy is likely to result fatally, a ligation of the superior poles or even of only one pole may first be done. When the patient has received the benefit of this operation, a more extensive one can be done removing part or even the whole of the gland. This is the multistage scheme of operation. With this scheme, however, when the surgeon is uncertain how much reaction will follow a given operation, he is confronted with the following dilemma: either he may subject the patient to an unnecessary number of operations with the attendant expense and delay, or in his desire to avoid this he may do too much and jeopardize the patient's life. It is easy to see therefore that the success of this scheme of operating depends to a very large extent upon the certainty with which the postoperative reactions can be predicted.

Most of the published work on the foretelling of postoperative reaction has been concerned with the preoperative study of the patient. So far as I know, nothing has yet been done toward a definite study of the

patient's behavior under operation and anæsthesia. This is mentioned only incidentally in the course of articles on other subjects. Yet much can be deduced from it. The patient's behavior is a test of her capacity of adjustment to the somewhat trying conditions of anæsthesia and operation. She is here seen under the worst conditions and her behavior under these conditions may throw considerable light on the severity of her postoperative reaction and on her power of resistance to this reaction.

In this clinic an attempt has been made to predict from the course of the anæsthesia the amount of postoperative reaction. This attempt has been fairly successful. The reactions were found to be roughly proportionate to certain signs occurring during the course of the anæsthesia. But occasionally patients were seen whose behavior under anæsthesia was apparently favorable, who nevertheless had severe postoperative reactions. Some of these had little or no reaction of the ordinary sort but remained quiet, apathetic or unconscious and died. This was disheartening and confusing. These few cases seemed to upset the criteria which we had been using in our attempt to foretell the postoperative reaction.

This paper is an attempt to clarify this situation, to ascertain more definitely the meaning of the various signs during anæsthesia and especially to study the occasional cases just mentioned. Are these cases just freaks which cannot be detected? Are they essentially different from the others but with characteristic signs which perhaps can be detected? Or do they follow the same general laws as the others and have we perhaps not yet learned their position under these laws or how to use the signs obtained?

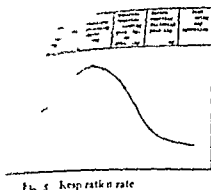


Fig. 5. Respiration rate

the sign represented by a given curve. The greatest excursion is shown by the pulse. Thus in this curve there is a greater difference between the different groups than there is in any other curve. For instance there is more difference in the pulse between Groups 1 and 2 than there is in the pulse pressure or blood pressure between these same groups. And the same holds true for most of the other groups. This should mean that the pulse is the most sensitive indicator of reaction. This agrees with clinical experience which has shown that the pulse rate is the most sensitive and reliable single guide available.

The pulse pressure shows the next greatest excursion and here again this agrees with clinical experience which is that second only to the pulse rate the pulse pressure is the best guide.

Only slightly lower than the pulse pressure curve is that of the systolic blood pressure. This agrees only partly with clinical experience for while it is next in value to pulse pressure in practical work it is not close to it in value as indicated by the curves being on the contrary considerably below it. The reason for this is the effect of cardiovascular disease on the blood pressures and the not infrequent incidence of such cases. In them the systolic blood pressure is often greatly elevated entirely independently of toxicity or of potential postoperative reaction. But the diastolic pressure is also elevated so that the pulse pressure is not increased in proportion to the increase in the systolic. Therefore an increase in systolic blood pressure is indicative of reaction only in

proportion as it is accompanied by an increase in pulse pressure.

The respiration curve shows the least excursion of any of the curves that reverse on themselves. In practice the rate of respiration has seemed to be of very little value and of considerably less value than the character of respiration.

The diastolic blood pressure curve shows such a slight excursion that individual variations of different cases greatly exceed the difference between the groups and make this sign of little or no value. This again agrees with clinical experience.

In looking at Curves 1, 2, 3 and 5 we are struck by the fact that in Group 7 consisting of the 5 patients that died the pulse rate the systolic blood pressure and the respiration are very near in height to the first group the group that had no reaction. They are nearer this group than they are to any group which had reaction. The pulse pressure in Group 7 is close to that in the groups which had slight or moderate reaction. Only in the diastolic blood pressure is the last group further removed in value from the first group than are any of the others and the diastolic blood pressure is of little value as explained above. The position of the last group in this curve, however, suggests the possibility that while the diastolic blood pressure has been of little clinical value in the past a closer study of it may serve to differentiate this last group of those that so badly from the other group which while showing similar anesthesia charts does very well.

We have just said that the first part of many of our curves a part which represents patients with the very best postoperative recoveries is about on a level with the end of these same curves which represents those patients that died or did very poorly. These two groups of patients being at about the same height in the curves evidently show readings of about the same character during anesthesia and yet their postoperative recoveries are absolutely different. It is therefore very important to differentiate these two groups one from the other. Let us then for purposes of study reclassify our original groups into these two new groups which

correspond to these two portions of our curves. The first of these newer groups is composed roughly of the first of the original groups with some of the second and third. The second of these newer groups is composed of the seventh original group and perhaps some of the sixth. Here then we have these two groups which it is vitally important clinically to differentiate one from the other and yet we have little in the anæsthesia charts to help us do it. This is the peculiar and striking fact brought out by these curves.

However these two newer groups can be differentiated with a fair amount of certainty by the appearance of the patients on coming to the operating table and by the depth of anæsthesia necessary during operation. Patients in the first of these two groups the one which is destined to have a comparatively slight postoperative reaction come to the table with a normal color or only a slight flush and in a rather drowsy condition from the preliminary narcotic. These patients awaken readily on being disturbed but quickly fall asleep again when left alone. Occasionally they remain definitely awake and they are seldom sound asleep. There is nothing unusual about the depth of the anæsthesia required just the ordinary average depth. These patients react somewhat to the various operative procedures requiring greater depth if there is traction or other disturbing procedure. In the second of these two groups the chart shows the same moderate readings but the patient is destined to have bad reactions with high mortality if much is done. is usually deeply flushed by the preliminary narcotic on coming to the operating table and is sound asleep. Sometimes the patients seem really unconscious and do not rouse in the slightest even when transferred from the truck to the table. Naturally under these conditions they require very little anæsthetic during the operation and they show little or no reaction during anæsthesia to various operative procedures. They run smoothly and easily and on so weak a mixture that they are usually a bright pink in color. Great caution should be exercised with patients in this condition.

In general while there are wide individual variations in the depth of anæsthesia the first of the original groups requires the deepest anæsthesia and the seventh the lightest with the depth decreasing fairly evenly.

Observation of the patients themselves before operation serves to differentiate these two newer groups with still more certainty. Pre operative study of thyroid patients has been discussed elsewhere so thoroughly that it is unnecessary to take it up in detail here. It is sufficient to say that the small group of patients with high mortality is of the type that appears apathetic and exhausted. Their vitality is apparently so low that they lack the capacity to run the high pulse and blood pressure seen in the higher parts of the curves. Neither do they get the asthmatic activated type of postoperative reaction. If the operation proves too severe an ordeal for them they remain quiet apathetic or unconscious and die without the restlessness and activity seen in the more usual form of thyroid storm. The other newer group of patients with which this group might be confused if reliance is placed only on the anæsthesia record is pre operatively a comparatively well group not easily confused with this apathetic and exhausted group.

If we return to the question propounded early in this paper whether the few unusual cases mentioned are governed by the same general laws as the others we apparently can say that they are. These cases appear mainly in the seventh with probably some in the sixth of the original groups. We have found that the anæsthesia readings of these seven original groups when plotted as graphs form definite curves with the groups arranged in regular order from one to seven. Therefore it seems highly probable that these occasional unusual cases which group themselves at the end of these curves are not in themselves essentially different from all the others but are simply the end product of thyroid toxæmia. They are the exhausted remnants left from the conflict with the disease with too little remaining strength to react in the usual way to the stimulation of anæsthesia and operation.

Of course no claim is made that just these curves would be obtained in any series of

toxic patients. In fact if in this same series the apathetic case had been regarded with more caution and the activated type treated with less the descending part of the curve would undoubtedly have been shorter. And no claim is made that these curves form a rule of thumb by which alone the postoperative reaction can be accurately judged. Individual variations are too great. But clinical experience shows that in any anesthesia there will be at least one sign giving a definite indication of any considerable postoperative reaction and the likelihood and intensity of postoperative reaction is roughly in proportion to the number and intensity of the signs indicating such reaction. It is believed that these curves do bring out the significance of certain of the more important factors useful in reaching an accurate postoperative prognosis and present them to the eye in a somewhat striking form.

#### CONCLUSIONS

1. In the great majority of toxic thyroid patients under nitrous oxide oxygen anesthesia with the technique used in this clinic a postoperative reaction is indicated roughly proportionate to the increase above normal in pulse rate, pulse pressure, systolic blood pressure and respiration.

2. In a small group of patients the disease has apparently progressed beyond the con-

dition in which this is true. With them the postoperative reaction and especially the postoperative mortality is roughly in inverse proportion to the increase in the pulse rate, pulse pressure, systolic blood pressure and respiration.

3. The small group of asthenic and apathetic and their operative mortality is high.

4. A much more accurate forecast of the postoperative reaction of toxic thyroid patients can be made by taking into account both the preoperative condition of the patient and the course of the anesthesia than can be obtained from either of these procedures alone.

The charts all show reading at operation which precede various amounts of postoperative thyroid reaction. As nearly as possible the reaction to a given amount of operation increases steadily from left to right. This is shown at the top of the charts. The scale for reading the curves is at the left. It will be noticed that in the pulse rate, systolic blood pressure and respiration rate while there is a wide excursion in the middle of the chart yet the two end ones representing those patients having no reaction and the other representing those who died have approximately the same reading and in the pulse pressure the same tendency though less pronounced is also apparent.

## CHRONIC PEPTIC ULCER IN CHILDREN<sup>1</sup>

By OSCAR S. BROCK, M.D., ROCHESTER, MINNESOTA  
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SINCE a century ago when our knowledge of peptic ulcer as a clinical entity began isolated and infrequent cases of gastric and duodenal ulcers in children have been reported. The condition was regarded as extremely rare and it is only in the last 15 or 20 years that ulcers of the stomach or duodenum in children from all causes and acute or chronic have been noted more frequently. Chronic peptic ulcer however remains rare. With very few exceptions the ulcers reported were found at necropsy. A small number have been discovered during operations and a very small number have been diagnosed clinically.

A careful review of the literature shows that until recently all ulcers from whatever cause and whether acute or chronic were reported together in series. An exclusive study of chronic peptic ulcer in children has not been made and yet clinically this is by far the most interesting type.

I shall here consider an ulcer chronic only when symptoms or signs of its existence have been present two months or longer or when an ulcer without symptoms or symptoms of short duration is calloused or indurated with raised edges or has sufficient adhesions to neighboring structures of a character which leave little doubt that the process is chronic. The patients in the series are 14 years of age or younger. It would seem almost superfluous to mention this but for the fact that certain writers include in their cases of ulcer in children patients 15, 16 and even 18 years old.

Ulcerations which are an incidental part of a generalized tuberculosis or of an acute or chronic infection in which the ulcer is a secondary or antemortem condition will not be considered here even if possible symptoms of it have been present as rarely happens for as long as months. Also cases of an ulcerative process affecting the gastro intestinal tract as a whole and only incidentally the stomach will be excluded.

Among the other conditions causing secondary ulceration of the stomach or duodenum and not the true peptic ulcer such as burns, uremia and so forth I find no cases which could be construed as chronic. Although the literature is extensive I have found reported only 19 cases which judged by the standards already mentioned could be regarded as chronic peptic ulcers in children and 2 cases which are questionable. These are briefly as follows:

July 1943. A girl aged 3 years had had symptoms for 2 years when perforation and thrombosed ulcer was found on the lesser curvature of the stomach.

A boy aged 14 years had had g t e  
d t bance f r 2 vea s during the m nth b f e he died  
the vmp t ms were ry were Necr psv revealed p  
f rat g g stric ulcer

Five of 900 (0.5%) girls aged 14 years had had symptoms of rickets. There was relief from treatment, then relapse and the cure up to the time of the report.

The bird, 9004, a girl aged 3 years had had symptoms for 5 months and then developed acute peritonitis. Drainage of the abscess was followed by death. At necropsy perforation of ulcer on the greater curvature of the stomach was found.

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 Leary 907 Agil aged 7 ye had been a ling abo t  
 year when she had a sudd n profuse hrm rhage from  
 whi she recovered

Admitted 7. A girl aged 8 years had had hemorrhage since birth. She was placed under medical treatment for 5 weeks and recovered. She had been ill 5 months at the time of the report.

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Operation revealed a perforated duodenal ulcer she re-

V n Cack c 9 A boy g d 4 y rs had h d  
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A girl aged 13 years had had symptoms of pyloric stenosis of the pylorus with vomiting. The patient recovered.

The 1919 Agil had 3 years had had symptom  
fo about 4 months wh pe fo ti n occurred Ope ati n  
perf m d f r s ppo d append u d the ne

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N r l n 19 3 A g l g o l 7 year s h al h al t r o l e f r  
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Operat re l d l r g l l l r f i b e p y l ru s i th  
p e f r at Th h l d reco e r e l

### QUESTIONABLE CASES

C u 86 A boy g e d 5 y e r s h l h al s l e t t  
m p l m l r s e f l m n th w h p a n i n the b e l l  
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a l l t a l h r h e c n t c e l e s e l e f e U l c e r a g  
p e r e d n the g u m s l t g u th s l l e l v b l o o d y  
t o c l s d d th l l a f o u l o n th p o s t e r i o r s l a  
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R i e r 9 6 A girl aged 3 5 y e a r s h a d h l d g e s t i  
l t u l a n c s l e m r e t h a 2 y rs O n l m l t the  
h o p i t a l a l e h l l f r t e l b e l l y l m y t o w l l w a s  
m i t g S h r e c d l e t r a c t e d m l e a s t o o l  
b e a m b l o o d y l l l k a l t h e c h i l d d e d

### MAYO CLINIC CASES

In the Mayo Clinic from 1906 to 1924  
8 260 cases of peptic ulcer were observed of  
which only 2 were in children Of a total of  
1 596 gastric ulcers 1 was in a child (Case 1)  
Of 6 664 duodenal ulcers only 1 occurred in  
a child (Case 2) A third case is also one of  
duodenal ulcer although the first and third  
attacks were associated with coryza and the  
second with tonsillitis it seems that the ulcer  
was a chronic process activated by the infec  
tions and not that three separate acute ulcers  
were formed with each of these infections

CASE 1 A boy aged 14 years came to the Mayo  
Clinic July 16 1921 because of loss of appetite and  
abdominal pain The maternal grandmother had  
died from cancer and the mother had duodenal ulcer  
The pati t had had measles and mumps and influ  
enza with slight jaundice in 1920 In 1922 the tonsils  
and adenoids had been removed He had al w y s  
been und nourished because of lack of appetite  
At the age of two he had had an att ck of abdominal  
pain which caused him to cry all night He had  
never been strong and rugged and had always been

somewhat constipated Six years bef re com g to  
the Clinic he began to have attacks of pain in the  
abdomen The rest year he was fr e from the at  
tacks th v h al r e c u r r e d s i c e th n for 10 or 12  
days at a time with free intervals of as long as 6  
months Rec n t l y the attacks h al become l r g e r  
and closer together and at the time of e m a n a t i o n  
there was very little free interval The worst trouble  
h al always been just after scho l was out in June  
A dull c r m p i n g g r i n l i n g p i n w o u l d c o m e o n  
rather s u l l e n l y and u u a l l y in the region of the  
navel wher it was m o s t s e v e r e and sometimes  
cause l t e n d e r n e s s The p n r a d i a t e d o v e r  
the lower al t o m e n e s p e c i a l l y to the right It lasted  
from a few m i n u t e s to one half hour nev r longer  
At times it was s e e r e n o u g h to m k e th p a t i e n t  
c r y The pain o m e n c a m e on one half h u r after  
meals and sometimes about 2 or 3 o c l o c k in the  
morning although th e r was no regularity to its ap  
p e a r a n c e There was s l i g h t f o o d c a s e b u t no s o d a  
e r s e m t r l e f w a s o l t r e d f r o m d u b l i n g u p f r o m  
the use of a hot water bag or from lying flat with a  
pill w u n d e r th a t m e n There v e r e no h u n g e r  
p a i n s J a r r i n g of any k i n d u s u a l l y b r o u g h t on the  
p u n During the l t 6 m o n t h t h a t t a c k s w e r e  
a c c o m p a n i e d b y v o m i t i n g which a f f o r d e d s o m e r e l i e f  
Th v o m i t u s c o n s i s t e d of a s o u r w a t e r y m a t e r i a l  
b u t n o f l o o d n o r f o o l The p a t i e n t w a s n o t s u b j e c t  
to s o u r s t o m a c h and h a d h a l v e r y l i t t l e b e l c h n g  
O n t w o o c c a s i o n s d u r i n g the l a s t 2 w e e k s b e f o r e  
e x a m i n a t i o n the r e t u r n s f r m the e n e m a h a d b e e n  
as b l a c k as t a r There h a l r e c e n t l y b e e n s l i g h t l o s s  
of w e i g h t

At examination the child was poorly nourished  
there was a definite spot of tenderness to deep pres  
sure 3 5 centimeters to the right of and slightly  
above the umbilicus Retardation of development  
was marked The urine blood Wassermann and  
tuberculin tests were negative also the stool test  
proctoscopic examination and colon ray There  
were plugs in a remnant of the right ton l and a  
light dental infection A test meal revealed 24 com  
b i d acid and 14 free hydrochloric acid a total of  
65 cubic centimeters The X ray and r e y showe l  
a l s i o n at the pyloric end of the stomach The  
parents were advised to keep the bo outdoors a  
good deal and to fore n o u r i s h m e n t He returned  
to the clinic October 10 having gained 3 p o u n d s  
but with all symptoms worse an l y e r s t e n t a n o r r e x  
A roentgenogram of the stomach rev a l e d the s a m e  
lesion of the p y l o r c e n l At operation October 17 a  
typical ulcer of the chronic penetrating type with  
callus and induration was found at out 5 c n t i m e t e r s  
above the pylorus The ulcer was excised a r t h e  
opening close l with chromic catgut and silk A  
posteri r g a s t r o e n t r o s t o m y was m a d The  
patholog l s report was s u m p l g a s t r i c u l c e r 22  
m i l l i m e t e r s i n d i a m e t e r

Since operation there has been no return of the  
former t r o u b l e and the patient g a i n e d 21 p o u n d  
in 2 months following operati on his general condi  
tion is also better

**CASE 2** A boy aged 13 years came to the clinic in October 1914 because of stomach trouble of 4 years duration. He had had whooping cough and his appendix had been removed 3 years before. The stomach trouble consisted of a dull dragging epigastric pain and vomiting which the father believed would have continued without treatment. The patient had free interval of 6 months but was worse in the winter. During the last 3 months he had vomited practically every night between 10 and 3 o'clock. The vomitus was very sour and as a rule larger in quantity than the food intake. It never contained blood. Vomiting relieved the pain as did soda and at times drinking water. Occasionally the patient vomited immediately after meal. He was very constipated. During attacks the patient lunched between meals but not on account of pain. Between attacks he did not do so.

At the time of examination the patient was thin and tall and weighed 76 pounds. The urine and blood were normal. A test meal revealed combined acid 50 and free hydrochloric acid 36. The roentgenograms revealed a pyloric obstruction with retention 2 after 6 hours. The stomach was large and the antrum dilated. Peristalsis was inactive.

At operation October 7 an ulcer of the duodenum was found to extend around the pylorus with great thickening and contraction. There was general mesenteric enlargement of the lymph nodes. A posterior gastro-enterostomy was made and the ulcer covered.

Convalescence was uneventful and in 1922 the patient who was just out of the army was in excellent health. He weighed 175 pounds and had never had any return of gastric symptoms.

**CASE 3** A boy aged 2 years was brought to the clinic because of a cold accompanied by sudden vomiting of blood. When a few days old he had received a burn from a hot water bottle which did not heal for weeks. He had also received a course of mercurial injections from a doctor for a supposed congenital syphilis. There was never any evidence of this and two Wassermann tests on both father and child gave negative reactions.

The child was admitted to the hospital. He was extremely weak with an irregular and thready pulse. Pallor was marked and the breathing was deep and sighing. The stool contained black and red blood. Fluids were given subcutaneously. Horse serum intramuscularly and soon after a transfusion of 200 cubic centimeters of blood. For many days there was blood in the stools and the child would omit milk and other food. A diagnosis of duodenal ulcer was made and the Sippy treatment instituted. The blood count gradually rose and the child was sent home on a diet and alkaline powders were given.

At the age of 2 1/2 years the patient developed a sore throat and fever and within 24 hours of this vomited about 240 cubic centimeters of dark red blood. The stools also contained blood. He returned to the clinic very anæmic and listless and



Fig. 6. Gastric ulcer from Case 1. a Anterior view, b lateral view and c sagittal section.

with a weak pulse. He was given a transfusion of 75 cubic centimeters of blood at once and later a transfusion of 350 cubic centimeters. Blood continued to appear in the stools. The hæmoglobin was down to 35 (Sahli). Two days later a hæmorrhage from the nose and throat occurred. The patient was put on medical treatment and was discharged cured. His blood had gradually improved.

At the age of 4 the child was again admitted to the clinic. He had been well and had gained in weight but the day before admission had developed a cold with fever. In the morning he had a severe hæmorrhage vomiting 360 cubic centimeters of coagulated and red blood and also had very large movements of what appeared to be pure blood. He was very anæmic and listless. A transfusion of 350 cubic centimeters of blood was given and medical management instituted. Gradually in the course of 2 weeks despite another transfusion he developed bronchopneumonia and died.

There was never any evidence of any condition other than ulcer to account for the bleeding and the diagnosis was clear. Necropsy was refused.

## ETIOLOGY

It is probable that the cause of chronic peptic ulcer in children is essentially the same as in the adult. In the cases reported in the literature two-thirds of the patients were females, a ratio which may be due merely to the relatively small number of cases recorded.

Predisposing factors which are supposed to have an influence in the adult are certainly





Fig 2

Fig 2 Low power view of a histological section of the stomach wall showing inflammatory cell infiltration.



Fig 3

Fig 3 Low power view of a histological section of the stomach wall showing inflammatory cell infiltration.



Fig 4

Fig 4 Low power photograph of the base of an ulcer showing granulation and fibrous tissue.

much less common in children and this may have some bearing on the rarity of the condition in children. The factors of worry and strain tobacco alcohol very highly seasoned foods and so forth are usually entirely absent. Huber compiled statistics tending to show the influence of heredity. While this is questionable it is interesting to note that in the first case in the Mayo Clinic series the mother of the boy had a duodenal ulcer.

It is always possible that under favorable circumstances an acute ulcer may become chronic. A large number of conditions have been found to be responsible for acute ulcers of the stomach and duodenum in children. Trauma has been thought to play a part and several cases are recorded in which it was definitely responsible for the rupture of an acute ulcer (13). The swallowing of crusts and foreign bodies had been noted by Jacoby and many others as a cause. Malnutrition and pedatrophs have already been mentioned. Fenwick, Summons and others have reported gastric and duodenal ulcers following burns but the condition is not very common according to the statistics of those who have performed necropsies on large numbers of children dying from burns.

Acute infections of all kinds have been responsible for ulcers. Cases of acute gastritis, septicæmia, scarlet fever, measles, pneumonia, meningitis, tonsillitis, influenza and so forth have been reported in which there has been found at necropsy acute peptic ulcer

as well as the cases reported by Gerdine and Helmholtz which seemed to be epidemic in nature. Chronic infections have also been causative and Imerwol and others have recorded ulcers in cases of nephritis and uræmia.

Hyperacidity is less common in children than in adults particularly in the first few years according to the extensive work of von Hecker, Bauer and Deutsch and other investigators. This is especially true in various pathological conditions. In Cases 1 and 2 of the Mayo Clinic series in which gastric analyses were made there was no hyperchlorhydria. The motility of the child's stomach is thought to be greater than that of the adult.

#### PATHOLOGY

The location of practically all the gastric ulcers (the 16 collected from the literature and Case 1 from the Mayo Clinic) was on the lesser curvature at or near the pylorus the usual location in the adult. One was on the anterior wall near the lesser curvature and the pylorus one was on the greater curvature near the fundus and in the only case of multiple ulcers the lesion was at the cardia. The duodenal ulcers were all on the anterior surface of the first portion of the duodenum near the pylorus with the exception of one which had perforated the second portion of the duodenum.

The gastric ulcers ranged from 1 to 3.5 centimeters in diameter. No duodenal ulcers were excised nor did any come to necropsy.

Approximately one third of the gastric ulcers had perforated one of these onto the spleen and one onto the pancreas in all cases of perforation there was general peritonitis. One duodenal ulcer had perforated onto the liver. There were adhesions of greater or lesser extent around all the ulcers. The gastric ulcers were practically all of the type ordinarily seen; a typical specimen is shown in Figure 1. The thickening of the walls, the rounded edges and the deep crater are evident. The microscopic sections (Figs. 2, 3 and 4) show the inflammatory reaction both in the mucous membrane of the stomach and in the deeper layers, also the extensive fibrosis at the base.

Approximately one third of all the ulcers were associated with definite stenosis of the pylorus, usually of considerable degree, and one ulcer had produced marked stenosis at the cardia.

There has been no indication that any of the gastric ulcers become malignant during childhood. Of the 833 cases of carcinoma of the stomach including malignant ulcers seen at the Mayo Clinic from 1906 to 1924, the youngest was 18 years old.

#### SYMPTOMS

The onset of symptoms may be sudden with the advent of hemorrhage or perforation and one may not be able to bring out any history of previous dyspepsia or complaints referable to the stomach. This however is very exceptional. It may be that in these cases mild digestive disturbances are disregarded or forgotten by the child. There is usually a history of stomach trouble extending over a period of months or many years, the longest time noted being 8 years. Generally the trouble comes in attacks of variable length and in some cases there is a seasonal incidence, the attacks being worse in spring and fall or winter. There are usually intervals of fairly good health.

The symptoms may be mild and attract little attention, as in one case in which pallor, failing appetite and loss of weight with occasional vague abdominal pain were the only complaints preceding perforation. As a rule, however, symptoms are very definite and at times severe.



FIG. 5. Röntgenogram showing gastric ulcer on lesser curvature.

Epigastric distress or pain, varying from a dull vague feeling of discomfort to acute pain, is present in practically all cases. It is usually dull to sharp, often cramp-like or boring, and may be localized or radiate to other parts of the abdomen or to the back. The duration varies widely from a very short period to several hours. As a rule, the pain comes on from 1 to 3 hours after meals, but it may come on at any time. Often it is present at night and wakes the child at 2 or 3 in the morning. Definite hunger pains are rather commonly noted. The pain is usually relieved by food and the child eats between meals to ease the distress. In 1 case even at the age of 4, the girl used to take food during her parents' absence to relieve the pain and would repeat this as long as the attack lasted. Soda when tried has seemed to give less definite results. Vomiting usually eases the pain for a short time or for several hours.

Gas bloating and belching do not seem to be prominent symptoms in children, but are not infrequently present.

Nausea and vomiting are present in most cases. The vomiting usually comes not long after a meal. The vomitus is sour as a rule, but seldom so much so as to cause a severe burning sensation. There is rarely a retention

type of vomiting the material being simply that taken at the last meal or gastric contents and mucus. The frequency of vomiting as a prominent symptom is probably partly accounted for by the fact that few cases are diagnosed or suspected of being serious lesions until some prominent objective condition becomes manifest.

Constipation is the rule and is often obstinate. Loss of appetite is a symptom frequently encountered. In many cases weakness or exhaustion is complained of.

Retardation of development is often striking and depends largely on the duration of the condition and the age at which it begins. In Case I (Mayo Clinic series) the boy with a 6 year history looked stunted and several years younger than he was. In the case of Farmentier and Lassar in which symptoms had been present 8 years the child looked 4 or 5 years younger. The influence of the condition may be such as to cause almost complete cessation of growth. Immaturation is at times severe in cases of pyloric obstruction.

Bleeding is present to some extent in about 40 per cent of the cases. It varies from blood streaks in the vomitus or traces in the stool to profuse hemorrhage. As much as a quart of blood has been reported to have been vomited or it may appear only as melenæ. There may be a low chronic loss of blood with no symptoms except pallor.

Perforation occurs in about 25 per cent of the cases. The symptoms of ulcer have usually been present from one to several years but the child is not brought for examination until perforation has occurred. General peritonitis is almost always present and the mortality has been about 50 per cent. The high incidence of perforation and bleeding in the cases reported is unquestionably due to the fact that most cases are unrecognized and unless one of the complications or a stenosis of the pylorus with vomiting is present the condition is as a rule not diagnosed.

#### DIAGNOSIS

The most important single factor in the diagnosis is the realization that chronic peptic ulcer occurs in children. It is found least often in early years and occurs with gradually in-

creasing frequency until the limits of childhood are passed. Chronic or recurring attacks of dyspepsia in a child should lead one at least to consider the possibility of peptic ulcer. Particularly is this true if the growth is retarded or if the child is underweight or pale.

Hyperchlorhydria is absent usually when present it may be helpful in diagnosis. Blood may be found in the gastric contents or in the stool especially on repeated examination.

The X ray is of great assistance in the diagnosis. The gastric ulcer is plainly evident on the lesser curvature in Case 1 (Fig. 5). In Case 2 a pyloric obstruction was revealed. Even among roentgenologists few will make a definite diagnosis of peptic ulcer but the fact that a lesion is present will usually be noted. In but few of the reported cases was an X ray examination made but there is reason to believe that the findings are similar to those in the adult. The motility of the stomach is greater in children.

#### TREATMENT

Medical treatment should always have a thorough trial unless there are definite contraindications such as marked tenderness at the pylorus repeated hemorrhages or perforation. Particularly in cases with a short history there should be no more favorable condition under which to try medical treatment for peptic ulcer. The regenerative powers of a child as is well known are much greater than those of the adult and constitute a most powerful factor in favor of cure. The management may be essentially the same as in the adult with modifications when necessary. It would be very hard for example to keep the younger children quiet. The younger the child the more prompt the response to treatment.

If medical treatment fails or if there is stenosis repeated hemorrhages or perforation the case becomes surgical. The simplest operations are best. In the case of a gastric ulcer it is probably wisest to excise it and to perform a pyloroplasty or gastroenterotomy. One does not have to be concerned over the possibility of the ulcer being malignant or becoming so during childhood.

For duodenal ulcer a simple excision or excision and pyloroplasty after the method of

Judd or C H Mayo is undoubtedly best. It is the simplest procedure and involves the least disturbance of the anatomy. If this is impossible or inadvisable particularly in cases of marked stenosis of the pylorus a gastro-enterostomy may be safely done or even a partial resection should conditions demand it.

In fact it would appear that one may do as much surgery on the stomach in children as in adults with little or no more risk. This would probably not include infants and very young children. The power to withstand shock seems good and the rapidity and vigor of the reparative processes are great. Theile reports the case of a 2 year old child in which de Quervain did a resection of the pyloric end of the stomach with uneventful recovery.

# DISCUSSION

Just what is the incidence of chronic peptic ulcer in children? Is it as rare as one would be led to believe from the cases found in the literature? Adult patients often say that they have had symptoms all their lives. Various writers have reported cases in which the symptoms dated back to childhood and have even reported them as cases in children. To throw some light on this question I determined from the records of the last 1 000 gastric ulcers and from the last 1 000 duodenal ulcers seen at the Mayo Clinic what percentage of the patients had symptoms in childhood. Sixteen of the patients with gastric ulcer had symptoms dating back to childhood even to the age of 4 or 5 years and 26 of those with duodenal ulcer. Thus 42 patients from a total of 2 000 with peptic ulcer or 21 for every thousand had the onset of their disease in children and often the condition dated back many years into childhood. The data leave little doubt but that the disease is often unrecognized in children and that if the possibility of the condition is borne in mind there will be a steadily increasing number of cases diagnosed and chronic peptic ulcer in children will cease to be a rarity.

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## AN UNUSUAL EXPERIENCE WITH NEPHRECTOMY FOR SUPPURATIVE NEPHRITIS

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C 1 g S g t h L H i l d S t F H p 1 N Y k

I HAVE been reminded of a case of acute suppurative nephritis that came under my observation 10 years ago by the article of Cunningham and Graves in the July number of SURGERY GYNECOLOGY AND OBSTETRICS 1924 xxxiv 39. The case presents some unusual features with regard to its etiology and corresponds in this respect to another case that I published in an article on unilateral hæmatogenous infection of the kidneys in the Festschrift for the fortieth anniversary of the German Hospital now the Lenox Hill Hospital of New York City in 1909 page 229.

In that communication I reported 4 cases and drew attention to the fact that the right kidney was more frequently involved than the left and that the far greater number of these patients were women. The cases at that time at my disposal were those that had been reported by Brewer and by Cobb\* which with my own amounted to 8 cases. Of these 24 were in women the right kidney being involved 21 and the left 3 times. Of the 21 right kidneys 2 had shown previous physical defects leaving 19 cases in which to all appearances the infection had occurred in a healthy kidney. As 2 of my 4 patients had movable kidneys I concluded that the latter in their exposed position were more easily affected by even slight traumata (contusion) than a kidney lying well under the costal border and were in consequence more liable to hæmatogenous infection.

In the literature of the subject I had found mention of the fact that violent contraction of the abdominal muscles and muscles of the back could produce lesions in the kidneys. Such lesions can be followed by a unilateral hæmatogenous infection. This happened in the case of one of my patients previously reported a young man who while lifting a heavy load felt a sudden severe pain in the left side which was followed by the develop-

ment of a suppurative nephritis. In the following instance violent muscular contraction no doubt was also responsible for some lesion to the kidney which led to hæmatogenous infection.

Mrs. C. 62 years of age had had a cholecystectomy for gall stones some years ago otherwise she never had any serious illness. On July 4 1914 while ascending the steps of her cottage she slipped and in attempting to prevent a fall she suddenly felt a very severe pain in the region of the left kidney which caused her to sink to the ground. She distinctly states that the pain came on while she was still on her feet. She had great difficulty in rising and walking into her house. She went to bed and remained there until I saw her on July 9 when her temperature in the mouth was 103.5 degrees pulse 110. She presented other symptoms of septic intoxication abdomen slightly distended region of the left kidney very tender to touch kidney apparently slightly enlarged. Nothing could be made out on the right side in the way of pain or swelling of the kidney. The patient was removed to the hospital on July 11 in a very serious condition. There was no opportunity of making functional tests of the kidney. The urine contained many pus cells but no organisms were identified. On July 18 days after the accident I exposed the left kidney through a lumbar incision. The organ was somewhat enlarged. After the capsule had been stripped off and removed the cortex appeared to be densely studded with milary abscesses (see illustration). Nephrectomy was done. On the afternoon of the day of operation we had the usual drop of temperature in this instance from 103.4 to 97.6 degrees. The patient seemed to be doing well during the next few days although the temperature gradually rose to 101.8 degrees on the evening of the second day. It fell to 99 degrees on the fourth continuing at this level until death occurred on the eighth day from renal insufficiency.

The autopsy revealed a suppurative nephritis also on the right side. I quote from the pathology report: "The surface of the right kidney in general is more evenly congested than that of the opposite side and the mottling is finer. Scattered over the surface are found numerous small gray points resembling milary abscesses. These are not nearly as abundant as in the left kidney removed at operation and show a far greater variation in size and regularity of distribution. The majority are small averaging about 1 millimeter. But in addition to these there are several patches a centimeter in diameter formed by conglomerated small tubules

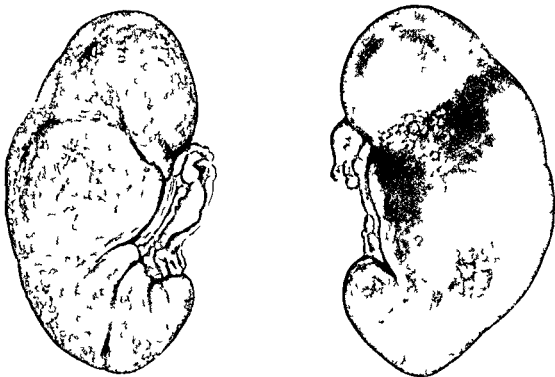


Fig. Drawing showing at left the right kidney and at right the left kidney

scases. On section the cortex is slightly less swollen than that of the left kidney the markings are finer and the milary abscesses are not as abundant. In the medulla they seem more abundant than on the left side.

Cultures were obtained (1) from urine a few days after operation (2) from the left kidney immediately following nephrectomy and (3) from the right kidney at autopsy. All showed the same organism in pure culture: *Bacillus coli communis*.

This is a case that has practically the value of an experiment on the living human being. The patient who had never suffered from any disease of the genito-urinary tract and in whom the autopsy revealed no pathological condition in the kidneys of old standing developed what at first probably was a unilateral hæmatogenous infection on the left side following a trauma. During her illness nothing pointed to an involvement of the right kidney. Although the pathologists report speaks of a greater number of milary abscesses in the medulla of the right kidney

the general impression gained from a comparison of the two kidneys (see illustration) is that the left is further advanced in disease than the right. Had the affection started simultaneously in both organs the disease would scarcely have made greater progress in a week on the left than in 2 weeks on the right side.

Cunningham and Graves distinguish between two types of hæmatogenous infection: the suppurative and the non suppurative diffuse inflammatory. These types should be recognized upon inspection at the time of operation as they require different treatment. This is very true and generally I think not very difficult. It is a more difficult task to decide upon the course to pursue in a given case of the acute suppurative variety after the kidney has been exposed and inspected. While the streptococcus and staphylococcus infections generally demand nephrectomy to overcome profound septic intoxication a colon

bacillus infection may present an equally urgent clinical picture as my case demonstrates. That a unilateral streptococcus on the other hand if not surgically treated at the outset can lead to abscess formation perforation of the capsule of the kidney and to a perinephritic abscess without fatal issue is shown by the history of the case previously mentioned in which infection also followed violent muscular exertion. The perinephritic abscess in that case was incised at the end of the second week. About a week later the kidney had to be removed as the septic condition was not relieved. Following nephrectomy the patient developed a streptococcus septicæmia. He was in the hospital for  $1\frac{1}{2}$  years with numerous metastatic abscesses including suppuration of the left hip joint. In all of the latter streptococci in long chains were found and blood cultures frequently taken showed the same micro organism. The remaining kidney was never involved. The patient finally recovered.

In the first case (Mrs. C.) I regard the invasion of the right kidney by the colon bacillus as not occurring simultaneously with invasion of the left for I do not see why the process should develop at the same time in both kidneys when the lesion on the left side was distinctly traumatic in origin. In none of my other cases did any symptoms develop after nephrectomy that could have been referred to the remaining kidney. Nor do I remember any report in the literature of the subject of a fatal issue because the second kidney also became the seat of a suppurative nephritis but this may be due to my inability at present to make a careful survey of the literature. Perhaps also in this instance as in many others successful cases are more apt to find their way into surgical literature than unsuccessful ones. I have often wondered whether the removal of the left kidney could be held responsible in part at least for the later involvement of the organ on the right side. A kidney that has ceased functioning can of course be removed without any untoward effect on the other kidney save such as may follow any operative interference.

Generally in the early stages of suppurative nephritis functional tests show somewhat retarded elimination on the diseased side when the urine otherwise may show little change either macroscopically or microscopically. I do not believe that the function of such a kidney has been seriously impaired when the patient has only been ill for a short time (in my case the accident leading to infection occurred  $7\frac{1}{2}$  days before nephrectomy was done). The removal of such an organ should have a different effect on the remaining kidney than the removal of a simple pus sac without function and I can appreciate that it might act indirectly as a trauma favoring the retention of germs still circulating in the blood and thus producing a secondary infection on the other side.

In removing the kidney I certainly deprived my patient of the only chance of recovery that she had. I do not mean to say that he would have recovered after one of the minor operations (decapsulation or nephrotomy) but I cannot exclude the possibility. The case only shows the difficulty of deciding at operation from the appearance of the organ after decapsulation what to do especially when no definite knowledge of the nature of the infection is at hand and when the other kidney is to all appearances sound. I have suggested in these cases decapsulation and packing of the wound cavity around the kidney which might be followed by a rapid nephrectomy if decapsulation alone produced no improvement. I did not follow my suggestion in this case because I considered the patient's condition too serious and had no reason to suspect an involvement of the other kidney existing at the time of operation or coming on later. The case is another argument in favor of conservatism by which I mean early exploratory operation with decapsulation even if in section of the kidney should occasionally disclose a faulty diagnosis. Nephrectomy should be added only if urgent symptoms of septic intoxication persist with the thought in mind that the latter even in apparently extreme cases of unilateral infection will generally subside after removal of the kidney.

SEPARATION OF THE ACROMIOCLAVICULAR JOINT<sup>1</sup>

BY BARCLAY W. MOFFAT, M.D., NEW YORK

THE treatment of separation of the acromioclavicular joint has as a rule been conservative that is by strapping and rest. In several cases seen recently by the writer the end result by this method has been so poor that operative measures seemed indicated.

The lesion varies from stretching of the ligaments binding these two bones together allowing abnormal play in this joint to rupture of the joint. From a mechanical point of view it would seem that strapping would be inadequate. The extended arm raised in abduction is a lever of the third class the power being the contraction of the deltoid which is inserted close to the fulcrum. The mechanical advantage of this muscle in respect to the location of its origin and insertion is also slight. It arises for the most part from the upper portion of the capula. The scapula in turn is steadied by the action of the clavicle as a strut.

From these considerations it may be seen that the force exerted through the acromioclavicular joint in the action of raising the arm must be considerable and from a purely mechanical standpoint it does not seem logical to suppose that stretched or ruptured ligaments will sufficiently bind the bones of this joint to allow function. There would seem to be a doubt of the efficacy in taking up the strain of strapping applied outside the skin and the bulk of the deltoid muscle.

The type of union sought for would be a fibrous union which would hold the bones firmly in contact and still allow the play necessary in this joint in raising the arm above a right angle. For this reason it will be seen that bony ankylosis is undesirable. Undoubtedly under treatment by strapping there usually occurs in a great number of cases contraction of the shoulder muscles anchoring the scapula so that the arm may be abducted by rotation of the scapula only. Such a result seems mechanically imperfect.

Of the following cases 2 had been treated for months by strapping with very poor result.

One of these 2 patients submitted to operation and regained full motion. The other refused operation. Of the remaining 6 5 were treated by curettage and fibrous union resulted and 1 was treated by insertion of a beef bone screw. Of the 5 4 have normal function as a result. The other was lost before his after care was completed but when last seen had a stable joint and abduction was limited only by weakness of the muscles. In the case in which the beef bone screw was used there resulted abduction slightly beyond a right angle but the immobility of this joint checks the upper range.

CASE 1 V V age 40 was admitted to the Orthopedic Service of Ann May Hospital Spring Lake New Jersey May 28 1923 following an automobile accident in which the patient was thrown violently against the steering wheel.

Local examination. The patient was unable to abduct the arm beyond 40 degrees and this movement was accompanied by much pain in the shoulder. The outer end of the clavicle was prominent. June 4 the joint was exposed and the articulating surfaces curetted. The clavicle was sewed to the acromion by double strands of chromic catgut through the periosteum of both bones. The arm was put up in a plaster spica with 90 degrees abduction. On June 25 the plaster was removed from the arm. Passive motion and massage were started. Patient was discharged from the hospital with directions to keep the arm elevated as far as possible. October 10 function was normal.

CASE 2 M S age 35 June 14 1923 was admitted to the Orthopedic Service of the Ann May Hospital. Alighting from a car the patient was struck by an automobile. The local condition was as in the previous case. June 19 the acromioclavicular joint was exposed. The articulating surfaces were curetted and a beef bone screw was inserted through the acromion into the clavicular head. The after care was like that in the previous case. November 10 1923 the patient could abduct the arm to 90 degrees only there being apparently a bony ankylosis at the joint.

CASE 3 G D age 30 was referred for complaint of inability to raise arm February 6 1924. The onset followed a strain while at work lifting heavy lumber.

Local examination. The patient could abduct the arm about 30 degrees in a plane 45 degrees anterior to the lateral. This is accompanied by rotation of the scapula. February 20 curettage and sewing of joint was done. At present time pa-



tient can abduct the arm to about 100 degrees with out rotation of the scapula and give motion beyond the joint shows that there is no bony ankylosis of the joint.

CASE 4. C. C. age 60 was referred on complaint of inability to raise the arm. March 10, 1924 the patient fell on the point of the shoulder. March 28 operation was done as in the previous cases. At the present time the patient can abduct the arm through the normal range without difficulty the scapula starting to rotate at 90 degrees.

CASE 5. T. S. age 28 was admitted to Orthopedic Service, Monmouth Memorial Hospital, Long Branch, New Jersey, unable to raise the arm. April 24, 1924 attempted abduction was accomplished by rotation of the scapula. Two weeks later operation the clavicle became locked to the acromion by over riding when it was possible to abduct the arm to 100 degrees by rotation of the scapula. With over riding corrected the range became limited to 30 degrees. The same operation was performed as in previous cases but at the time of discharge full function had not returned although there was firm fibrous ankylosis in the joint.

CASE 6. W. F. age 32 was admitted to the Hospital for Rupture of the Cranium with compound fracture of the arm 3 weeks after an automobile accident. An operation similar to that done in the previous cases was performed and in 1 month function returned.

CASE 7. M. B. age 40 was seen in consultation April 10. Operation was refused. The examination revealed the patient was shaken up in an automobile collision. The patient had pain in the shoulder

and was unable to raise the arm. The case had been followed by X-ray and showed increasing separation of the two bones entering into the joint. At the time of my examination there was contraction of the shoulder muscles so that abduction of the arm was possible to about 30 degrees only and was accomplished by rotation of the scapula. The patient had been treated by strapping but refused operation because her condition had become much worse immediately following the accident.

CASE 8. A. J. age 25 (seen with Dr. O. R. Heisters through whose courtesy the case is reported) was admitted to Monmouth Memorial Hospital June 23, 1924 with a complaint of inability to raise the right arm. The patient fell a week ago striking on the right shoulder.

Local examination showed swelling, discoloration and extreme tenderness over the right acromioclavicular joint. Abduction was painful and limited to 50 degrees. Operation June 24, 1924 corrected the curvatures and suturing of joint. The after care was like that used in previous cases. Normal function had been regained when seen on August 26, 1924.

#### CONCLUSIONS

1. Strapping is mechanically inadequate to restore function of joint in all cases.
2. The operation of choice is curettage and suture of the two bones resulting in fibrous ankylosis.
3. The use of internal fixation leading to bony ankylosis of the joint is undesirable.

IS DISEASE OF THE GALL BLADDER A CAUSE OF DIABETES MELLITUS?<sup>1</sup>

BY S. FRANKLIN ADAMS, M.D., ROCHESTER, MINNESOTA

Sect. M. d. M. y. Cl.

SEVERAL factors may contribute to the precipitation of diabetes mellitus but its true cause is unknown. Disease of the gall bladder in middle aged and elderly persons has been given considerable prominence as an etiological factor certain observers believing it to be significantly associated with diabetes mellitus. It is possible that infection in the gall bladder produces pancreatitis and finally changes in the islands of Langerhans with resulting diabetes.

Rolleston believes that diabetes does not favor the production of gall stones but on the other hand that cholelithiasis may indirectly produce diabetes (pancreatic).

Rabinowitch has determined the actual incidence of diabetes and of disease of the gall bladder in hospitalized patients and has compared these data with the incidence of the two diseases on the basis of probability. His findings appear to show that the actual occurrence of the two diseases is considerably greater than is indicated by the calculation of the probability. Eustis, O'Day, Carr, Hedinger, Dufourt, Hochhaus and others have reported cases which seemed to show a significant association between the two diseases.

Lichty and Wood on the other hand in a statistical study conclude that the case against the gall bladder as a causative factor in the precipitation of diabetes is not entirely proved.

For the purpose of further investigation of the subject I studied the records of a group of patients with disease of the gall bladder and diabetes mellitus who had been observed in the Mayo Clinic during a 4 year period (1920 to 1923 inclusive). Only the record of patients 40 years of age or more were considered and none was included if the diagnosis either of disease of the gall bladder or of diabetes was doubtful. During this period 6500 patients with disease of the gall bladder were seen at the Clinic. This number is as

accurate as the case records of any large group of patients will allow. It includes both medical and surgical cases and is made up almost without exception of cases of cholecystitis with and without stones. There were 1101 patients aged 40 years or more with true diabetes at the Mayo Clinic during the same period; these do not include patients with simple glycosuria or those showing in constant glycosuria when they were not on a restricted diet. One hundred thirty eight patients had both disease of the gall bladder and diabetes. According to these data there were 1 of 47 patients 40 years of age or more with disease of the gall bladder has diabetes and 1 of 8 patients with diabetes 40 years of age or more has disease of the gall bladder.

The patients who suffered from both diseases were divided into medical and surgical groups and questionnaires were sent to the 138 patients. Ninety two answers were received. Eighty nine per cent of the patients had had symptoms of disease of the gall bladder before they had symptoms of diabetes and 11 per cent had symptoms of diabetes first (Table I). As already stated one patient in 47 (2.1 per cent) with disease of the gall bladder has diabetes. From these two facts a third can be deduced that 89 per cent of 2.1 per cent or 19 out of every 1000 patients who have disease of the gall bladder will later develop diabetes. Of course on the other hand 981 will escape.

Another point was whether or not the removal or drainage of an infected gall bladder improved an existing diabetes. The percentage of patients who were improved based on the answers to the questionnaires appears to be about the same in 25 cases in which operation was not performed as in those in which it was. In 20 per cent of the surgical cases and in 25 per cent of the medical ones there was evidence of definite improvement in the diabetes (Table II).

TABLE I—ONSET OF SYMPTOMS

	Medical		Cholecystic		Cholesterol	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
Diabetes precedes gall bladder	4	5.4	1	6.2	22	45.8
Diabetes precedes gall bladder	7	9.5	1	6.2	8	6.6
Simultaneous onset of symptoms of gall bladder disease and diabetes	3	4	0	0	0	0
No symptoms of diabetes	4	5.4	—	—	1	2.2
Time of onset of diabetes doubtful	6	6	3	9.4	15	31.1
Time of onset of diabetes the gall bladder	5	6.8	1	5	0	0
Time of onset of diabetes doubtful	2	2.7	—	—	2	4.2
Onset of diabetes uncertain	1	1.3	0	0	1	2.2

TABLE II—EFFECT OF TREATMENT

	Medical		Cholecystic		Cholesterol	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
With high glucose in blood	2	65.6	7	53.8	4	75.0
With intolerance	8	5	3	3	6	9.7
With decreased tolerance	3	9.4	2	5.4	2	6.3
With high glucose in tolerance doubtful	—	—	7	7	0	0

Per cent based on cases in which treatment was given

With reference to tolerance for glucose the medical and surgical cases are probably comparable. It might be argued that in the medical cases symptoms referable to the gall bladder were not pronounced or else operation would have been performed. This hardly holds true because frequently when surgical treatment was advised the patient refused it. Moreover in the surgical cases a gall bladder was occasionally found that was only moderately diseased. It is sometimes difficult to determine whether patients with diabetes 40 years of age or more improve permanently

No patient was considered improved unless there was definite evidence of a permanent increase in tolerance for glucose. For example if when a patient left the hospital he was capable of keeping his urine sugar free only on a diet with a low or moderate glucose value and 2 or 3 years later was still aglycosuric on a diet considerably richer in glucose this was considered as indicative of improvement in tolerance.

Almost without exception all patients whether they had received medical or surgical treatment attended the lectures given to patients with diabetes at the Clinic so that they were well trained to care for themselves after they were dismissed from observation. The prolonged careful regime carried on by the patient probably accounts in part for the increase in tolerance observed in some cases. Obesity was a factor in certain cases and reduction of weight probably brought about improvement in the diabetes.

The cases of diabetes in this study were classified into the following groups: (1) acute progressive (2) obese (3) vascular and (4) doubtful (Table III).

TABLE III—TYPES OF DIABETES

	Metabolic		Cholesterol		Cholesterol	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
Obese	46	6	5	3	34	70.8
Vascular	6	2.6	6	37.5	6	2.5
Obese & vascular	3	4.0	1	6.3	0	0
Acute progressive	2	2.7	1	6.3	1	2.1
Doubtful	7	9.5	3	18.7	7	4.6

In Group 1 are included cases of acute progressive diabetes in which the cardinal symptoms developed suddenly with a tendency toward rapid loss of weight, strength and tolerance.

In Group 2 the patients were considerably overweight and the onset of the cardinal symptoms of diabetes was gradual.

In Group 3 there was definite evidence of arteriosclerosis and also a gradual onset of the symptoms of diabetes.

In Group 4 there was no obesity and no evidence of arteriosclerosis the diabetes was mild and the onset of symptoms gradual

It is worthy of note that in 70 per cent of the proved cases of cholelithiasis the patients were obese whereas in only 31 per cent of the proved cases of cholecystitis the patients were obese

Symptoms of disease of the gall bladder usually develop at the age of about 42 years and no signs of diabetes appear until about 50. This statement is based on an average of the ages in the medical and surgical cases (Table IV)

TABLE IV — AGE

	Medical			Cholecys			Cholelithiasis		
	C	P	Average	C	P	Average	C	P	Average
Total number	74	53	6	6	11	6	48	34	8
Average age at onset of disease of gall bladder			40			45			44
Average age of onset of diabetes			40			5			5

C d e r e g e t e f e a l l b l d d s y m p t o m a z a r  
C d e r e g e t e f e a l l b l d d s y m p t o m a z a r

Sixteen patients (11 per cent) had symptoms of diabetes preceding any manifestation of disease of the gall bladder. It is true that a gall bladder harboring infection but giving no evidence of it might have been present for some time but it is probable in a few cases at least that the diabetes actually preceded disease of the gall bladder. Table IV gives the various data relative to the time of onset of the two diseases.

It is likely in many cases that by the time a patient with a diseased gall bladder comes to operation the liver and pancreas are probably already permanently damaged. The extirpation of the gall bladder may remove a source of continuous irritation but in all probability no regeneration of parenchymal tissue or improvement of hepatic and pancreatic function can be demonstrated.

Apparently the duration of the gall bladder symptoms has no relation to the degree of

severity of the diabetes because of the whole group comprising this series only 4 patients had acute progressive diabetes the form of the disease in which the maximal severity is to be expected. The patients who had symptoms referable to the gall bladder for a long period were not those who had the severe type of diabetes.

The data used in this study are based almost wholly on the findings at the bedside in the laboratory of surgical pathology and in the operating room. They are therefore open to a greater error than if they were based on data obtained at necropsy. Mentzer has shown for example that about 80 per cent of the tissues examined after death of persons more than 40 years of age have signs of inflammation in the gall bladder. In such event if diabetes were a usual outcome of cholecystitis one would expect the incidence of diabetes in the population at large to be higher. Probably the true answer will not be known until it has been definitely proved that cholecystitis usually causes some inflammatory change in the acinar tissue of the pancreas and that pancreatitis is usually accompanied by changes in the islands of Langerhans. This is a difficult point to prove and would require a close study of the entire pancreas in a large series of cases.

It is well known that an infectious process has a pernicious effect on a coexisting diabetes and that the disappearance of such infection brings about improvement in glucose tolerance. The removal of any localized infection whether it is in the gall bladder, kidney or tonsil may diminish the severity of a coexisting diabetes. It seems hardly justifiable therefore to expect more improvement following the removal of an infected gall bladder than following the removal of any localized infection simply because the gall bladder happens to be the close neighbor of the pancreas. It is quite likely that an infected gall bladder of itself does not cause diabetes mellitus by first producing pancreatitis or by some other mechanism. It may be however that the infected gall bladder is one of several contributing factors. Often persons 40 years of age or more are obese and usually have some arteriosclerosis

these factors plus an infected gall bladder may suffice to throw the balance in favor of a mild diabetes. Two men may not be able to lift a weight but with the help of a third man the weight may be lifted. Possibly a diseased gall bladder is in the position of the third man in cases of diabetes.

It should be mentioned that in this series of cases surgery was not necessarily attempted with the idea of diminishing the co-existing diabetes but because of the gall bladder per se this is a constant policy in the Mayo Clinic in deciding whether a patient should or should not undergo an operation. If the symptoms of disease of the gall bladder are of themselves sufficient to warrant operation it is advised. With the decreased mortality following operation in cases of diabetes (10) there has been no hesitation in submitting patient with diabetes to operation.

#### CONCLUSIONS

1. Disease of the gall bladder is a doubtful factor in the causation of diabetes mellitus. With associated obesity or arterio sclerosis or both it may play a part.

2. Our statistical evidence does not support the view that the removal of a diseased gall bladder will favorably influence co-existing diabetes.

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## CHEMOTHERAPY WITH RIVANOL

2 AETHOXY-69 DIAMINO ACRIDINE<sup>1</sup>

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U. S. S. R. J. B. D. P. S.

## THE EVOLUTION OF CHEMOTHERAPY

CHEMOTHERAPY as conceived by Ehrlich implied a systematic search for chemical substances with a strong affinity for parasites and a weak or possibly no affinity for the cells of the host. The relation of the parasitotropic and organotropic qualities of a drug to each other is the therapeutic index of that drug. The great number of efficient substances that have been synthesized by Ehrlich and his coworkers indicate the fruitfulness of this simple diagrammatic theory. Results in trypanosomal and spirochetal infections have been of the greatest value and have stimulated further investigation. Yet more and more facts have presented themselves which could hardly be explained by an effect on the parasite alone. The participation of the host, disregarded in Ehrlich's original conception, seemed to gain in importance. As emphasized by Dale in his review of chemotherapy (19) the original conception of Ehrlich, although vital to the evolution of chemotherapy, has served its purpose and is now regarded merely as an excellent working hypothesis.

One of Ehrlich's coworkers, Morgenroth (47) developed Ehrlich's idea further. Parasitotropy and organotropy are no longer regarded as opposites; on the contrary, the affinity of a drug for the cells of the host acts as a link which enables the antiseptic to attack the parasite. It was suggested that quinine acted on malarial plasmodia because of its demonstrable storage in the erythrocytes and the same statement was made with regard to Morgenroth's new acridine derivative, rivanol (52). In this process of depot formation and gradual liberation of the active substance, Dale sees a widespread importance for chemotherapy. The phenomenon by which a substance passes from one medium to another, both having strong affinities for it, is called transgression by Morgenroth. The

phenomena of acquired resistance specific for the infected host as well as for the infecting strain show that the co-operation of the host must be regarded as more active.

In experiments of Dale and Dobell, a strain of *Entamoeba* which was susceptible to treatment by emetin in the human patient was completely resistant to emetin in kittens to which it had been transferred before the beginning of the treatment. The immune reaction of the host in the chemotherapy of pneumococcal infection with optochin was emphasized by Neufeld and Engwer. Engwer and Moore. The last named showed that the combined effect of optochin and antipneumococcal serum was about fifty times greater than a summation of the two effects. When the antiserum was used against a group other than that to which the infecting pneumococcus belonged, no result was obtained. That the effect of a chemical agent on septicæmia is not a direct disinfection is further demonstrated by the observations of Felton and Dougherty (27). These authors found an optimal dose of optochin for the prevention of septicæmia with simultaneous injection of multiples of the lethally infecting dose of pneumococci. On increasing the dose of optochin beyond this optimum but still below the host's tolerance, the same number of pneumococci produced a fatal septicæmia. As Dale points out, the higher dose suppresses the defensive reaction of the host, and the simple antibacterial action is inadequate without the reinforcement. Using urotropin intravenously for generalized infection, I tried to explain its action as a stimulating effect on the defensive reaction of the patient (70). A simple antibacterial action, as shown *in vitro* by Buzello, would require 115 grams instead of 4 grams daily.

All these observations point conclusively to an active participation of the host in any attempt at antiseptics. Whether this is a non-

specific healing inflammation' or a specific immune reaction produced by chemical anti sepsis cannot be decided. In connection with local injections of antiseptic agents questions of alkalinity of the tissues adsorption and absorption of the injected drug will arise, these will be discussed later

#### THE VALUE OF EXPERIMENTAL INFECTIONS IN CHEMOTHERAPY

If the defensive reaction of the host plays such an important part in chemotherapy the test tube experiment cannot be of decided value in determining how the drug is going to act *in vivo*. It has long been known (5) that most antiseptics enter into combination with the proteins of the body and their efficacy is thus greatly reduced. Therefore serum (65-66) and even pus from human infections (15-39) were used to suspend organisms and antiseptics tests were carried out in these media. Even these conditions are extremely simple as compared with those in the living tissue. Brunner von Gonzenbach and Litter and Braun and Goldschmidt produced fatal anaerobic infections in guinea pigs with minimal quantities of highly pathogenic earth samples (0.05 gram) that were sewed in pockets under the skin. As the untreated control animal always died from tetanus or malignant oedema the value of different antiseptics in different concentrations combined with mechanical antiseptics and open treatment could be estimated in exceedingly clear cut experiments.

Neufeld (55) experimented with various acridine dyes with regard to their value in pneumococcus and chicken-cholera infections. Feiler using the method of Braun rubbed diphtheria strains into superficial wounds and tested out trypanflavine by this method. Reinhardt made the very significant observation that trypanflavine (1:100) had a marked neutralizing effect on diphtheritic toxin and not merely a bactericidal action. Morgenroth (47-48-49-51-53) succeeded in producing slowly progressing infections in mice with avirulent strains of streptococci and staphylococci obtained from pyogenic infections in man and injected in animals without being carried through animal passage. Those animals

which were not treated died from generalized sepsis whereas those which received local infiltrations with nivanol were saved. The bacteria were killed off in the tissues as proved by cultures taken at various intervals. At the same time the reaction of the normal living tissue to various concentrations could be studied histologically.

Axhausen uses the sensitive cartilaginous cover of the knee joint of the rabbit to test out the effect of antiseptics on normal living tissue. Odermatt found marked vasoconstriction on the ear arteries of rabbits after the use of locally injected cinchona derivatives (eucupin, vuzin, optochin). Nivanol acted in a similar way. In a recent extensive experimental and clinical study of the two acridine dyes trypanflavine and nivanol Brunner and von Gonzenbach give a complete review of this and of other experimental work along this line. Comprehensive bibliography may be found in their article.

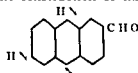
That animal experiments allow a more close and appropriate study of antiseptic agents than does the test tube is evident. Their value in relation to clinical experience will be discussed later.

#### THE ACRIDINE GROUP

The use of dyes in antiseptics originated in Ehrlich's vital stain studies. As early as 1891 he published some observations with Guttman in which methylene blue which stained the malarial parasite was selected as an agent that might possibly cure malaria. Later Ehrlich with Shiga produced and used a great number of various dyes. It is curious to follow the evolution of the dye antiseptics up to the present time and see how a drug selected for its evident fixation by the protoplasm slowly loses its dye character as already manifested in nivanol in contrast to trypanflavine. This characteristic is most striking in Bayer 203, a colorless non-dyeing fluid with a most elective curative effect on certain types of trypanosomiasis. The best known acridine dye trypanflavine was synthesized in 1912 by Benda used by Ehrlich because of its trypanocidal action and studied extensively in England by Browning and his coworkers who found it to have a powerful bactericidal action that was

not inhibited but augmented by serum with little toxicity for the host and hardly any depressant effect on its leucocytes. Besides trypaflavine (or acriflavine) certain other derivatives of this group such as flavine and acridine orange have been used by Neufeld in the treatment of chicken cholera produced experimentally. Smith has used various acridine compounds in experimental tuberculosis of animals with negative results and quite recently Lewis tested out a series of these dyes synthesized by Jacobs and found that the ripening of the oocyst of coccidia in rabbits prevented by acridine hydrochloride.

Morgenroth (49) after having suggested quinine derivatives (eucupin and vuzin) for local infiltration antiseptics recognized in a systematic search of various cinchona and acridine derivatives the antiseptic value of a member of this latter group, 2-ethoxy-6,9-diaminoacridine known commercially as rivanol. The construction of this dye was given as



and the soluble hydrochlorate was used. Morgenroth's description of this drug is as follows: a light yellow fine crystalline powder soluble in approximately 260 parts of water at 25 degrees C. and 8 parts of hot water. The solutions are yellow and fluorescent but darken when exposed to light for several days and may show a slightly brown precipitate. The aqueous solution is stable to boiling; the reaction to litmus is neutral.

Morgenroth determined the antiseptic power of rivanol in living tissue. A dilution of 1:40,000 sterilized experimental streptococcus which showed phlegmon in the subcutaneous tissue of the mouse within 24 hours. These results were obtained with more than 40 different strains. In the test tube streptococci were destroyed in the presence of serum by a concentration of 1:100,000 thus giving the favorable antiseptic index of  $\frac{40,000}{100,000} = \frac{1}{2.5}$ . In

staphylococcal infections the index was greater than 1. Although trypaflavine was shown to be more efficient in the test tube rivanol was more effective in the subcutaneous tissue of the mouse showing the value of the biological tests. Solutions of 1:1,000 and 1:500 are well tolerated in the subcutaneous tissues of mice and horses and do not cause any injurious effects. More concentrated solutions cause infiltration. The lethal dose for the rabbit is 100 milligrams for each kilogram of body weight if given subcutaneously and 50 milligrams if given intravenously. This slight toxicity permits the use of a large amount of the diluted concentrations in man and favors its use in powder form to a much greater extent than trypaflavine does, the latter being much more toxic.

#### TISSUE ANTISEPSIS

On this experimental basis a local tissue antiseptic was suggested and rivanol recommended for clinical use. Since the first appearance of this dye in 1921 a large number of articles have appeared on this subject. It must be emphasized that trypaflavine and rivanol are the only known substances which in spite of a very strong affinity for certain pathogenic bacteria such as streptococci and diphtheria bacilli do not cause any tissue necrosis or infiltration and that the attack on localized infections by local tissue antiseptics is utterly different from the intravenous treatment of localized foci with beginning generalization. While the intravenous use in combination with antistreptococcal serum (50 to 100 cubic centimeters of 1:1,000 solution of rivanol plus 50 cubic centimeters of antistreptococcal serum) is advised by noted clinicians such as Bumm and Sigwart in puerperal sepsis and is used in the form of intramuscular injections of from 150 to 200 cubic centimeters of a 1:500 solution in generalized sepsis by Rosenstein the main significance of its use in my opinion lies in the possibility of a local infiltrative method that has hitherto not been possible with our other strongly caustic and protein precipitating antiseptics. As is the case with local anesthetics the locally injected antiseptic must not damage the living tissue, must not be toxic in the necessary quantity and concentration and must not be resorbed.

The local antiseptic index was determined by the method of Morgenroth (49) as follows: The test tube method was used. The antiseptic index was determined by the method of Morgenroth (49) as follows: The test tube method was used.



too rapidly from the place of application also a certain storage an antiseptic impregnation (47-64) must take place in order to inhibit or destroy bacteria in a satisfactory concentration and over a longer period

With this new form of infiltrative antiseptics some physicochemical questions arise that have not had to be taken into consideration before. Schade has shown in his remarkable intravital measurements of hydrogen ion concentrations in normal and inflamed tissues that there were different degrees of local acidosis depending on the intensity and duration of inflammatory processes. Transudates, exudates, chronic suppurations and acute abscesses showed an increasing degree of acidosis from 7.25 (pH 37 degrees) to 5.95. Michaelis and Hayashi have proved on the other hand that the antiseptic concentration of rivanol is distinctly dependent on the hydrogen ion concentration. With a hydrogen ion concentration of 8.4 a 1:32,000 solution inhibited the growth of staphylococcus whereas a hydrogen ion concentration of 5.2 decreased the antiseptic concentration to 1:1,000. The lowering of the hydrogen ion concentration was also followed by a decrease in surface tension. The highest acidity noted in acute pyogenic abscess was 5.95 in Schade's experiments which corresponds to an antiseptic solution of rivanol 1:4,000. Concentrations of 1:1,000 to 1:2,000 are therefore apparently beyond the limitations of this acidity factor. It is curious to note that trypaflavine did not seem to be influenced by the change in acidity. This local acidosis at the site of the inflammation was the basis of my intravenous urotropine therapy in which the splitting of urotropin into formaldehyde and ammonia takes place in the infected tissue wherever it may be and not in the stomach when urotropin is given orally.

The grade of dispersion is another factor that has to be considered in local antiseptics. A slow diffusion and a high adsorptive character should be postulated in this form of antiseptics. In the inner antiseptics by the intravenous route the chemical agent must be easily diffusible because of a high grade of dispersion and slight adsorption. Therefore an efficient tissue antiseptic like rivanol will not necessarily be useful as an intravenous

therapeutic agent. Trypaflavine because of its physical properties would seem to be more suitable for this purpose.

#### THE CLINICAL USE OF RIVANOL

Although animal experiments may lead to valuable conclusions regarding human infection the conditions are not exactly analogous and therefore the conclusions can only act as a guide in our therapeutic measures. The difference in the amounts and virulence of infecting organisms in human infection the different defensive reaction of each individual and the anatomic and physiological differences of various tissues all complicate our problem. And above all as Brunner (13) emphasized in his classic studies on experimental and clinical wound antiseptics in the evaluation of our clinical results the control animal is always missing. We never can tell what course the infection would have taken with another form of treatment or without treatment.

We began a clinical study of this dye with the aim of testing its value on localized pyogenic infections. Freshly prepared solutions of rivanol were employed. Doubly distilled water and later ordinary tap water were boiled on an open flame the weighed quantity of rivanol (or tablets containing 10 centigrams) was added and boiling continued until the dye was completely dissolved. If the injection was to be made subcutaneously or intramuscularly novocain tablets were added to make up a 0.5 to 0.25 per cent solution. The addition of adrenalin is unnecessary. Rivanol itself causes marked vasoconstriction as shown by Odermatt. Concentrations of 1:500 were used for filling cavities whereas solutions of 1:1,000 to 1:2,000 were used for infiltration antiseptics. Intravenous injections were not given for the theoretical reasons already stated.

#### LOCALIZED PYOGENIC ABSCESSES

Aspiration of the pus with bacteriological control and filling with rivanol 1:500 was done in 31 cases following the technique of Haertel and Kishalmay. The normal skin was punctured with a large cannula 2 to 3 centimeters from the abscess through an intra

dermal wheal of novocain. About two thirds of the aspirated pus was replaced with rivanol. This was repeated every second day and bacteriological controls were made. An average of three punctures was made. Sterilization of the abscess cavity resulted in 26 of 31 cases (83.8 per cent) but as Haertel and Kishalmý pointed out healing cannot be expected before the necrotic tissue and the precipitated fibrin net are removed. These act as a foreign body and lead to sinus formation. Therefore after the abscess is sterilized or at least after the virulence of the bacteria is very much reduced two small stab wounds are made 6 to 8 millimeters long the contents gently expressed and a compression bandage applied. The walls of the abscess being brought together and no foreign body being present to disturb regeneration healing takes place in from 6 to 8 days. It might well be asked why make these painstaking injections if after all incisions are necessary. The two small stab wounds however cannot be compared to the long incisions we are forced to make at the height of inflammation. Painful dressings are avoided the duration of the process is shortened and the cosmetic results are much better. Tuberculous abscesses were not treated.

Table I shows our results in localized pyogenic infections. Subcutaneous abscesses and bursitis yielded much more readily to this treatment than glandular abscesses. If after two punctures the temperature and pulse did not drop the inflammatory process progressed or remained stationary the abscesses were exposed by means of large incisions. The cause of failure aside from individual degrees

of defensive reaction and a mixed bacterial flora that responds much less to disinfection according to Ritter's observations is chiefly the large amount of necrotic material that cannot be removed through the small stab wounds. Besides the glandular abscesses are always multilocular and the pockets not so easily accessible. In contrast to Rosenstein's favorable results Baecker reports only very moderate success in the treatment of mastitis. We obtained the best results with well walled off unilocular abscesses with little necrotic material.

#### PLEURAL EMPYEMA

The treatment of pleural pyogenic empyema is one of the most important phases of thoracic surgery. Although a thoracotomy or a rib resection saves the patient's life and relieves him from the dangers of a generalizing infection prolonged convalescence with endless sinuses may follow as a result of rib osteomyelitis insufficient lung expansion bronchial fistulae and so forth. Fischer (29) recently gave a comprehensive review of the efforts in the closed treatment of empyema and considers the removal of the fibrin masses one of the most important factors in obtaining permanent results. I had the opportunity to follow his technique in two instances. An extensive rib resection (8 centimeters) is made of one or two ribs and the fibrin masses on the diaphragmatic surfaces are thoroughly removed. The cavity is carefully irrigated with warm saline solution. If there are no bronchial fistulae the cavity is filled with about 100 cubic centimeters of a 1:500 solution of rivanol. Pleura and muscle are sutured watertight and positive pressure is simultaneously applied to the lungs in order to facilitate expansion. The skin is pulled together very loosely and the subcutaneous tissue is drained for a few days. In both of our cases four further aspirations were made and the cavities again filled with rivanol until no exudation could be demonstrated under the fluoroscope. In both cases the empyema was metapneumonic the patients were very debilitated and pure cultures of streptococci were obtained.

It is evident that only recent cases without thickened pleura will yield to this treatment and if the lung does not expand thoracoplasty

TABLE I—RIVANOL TREATMENT OF LOCALIZED PYOGENIC ABSCESSES

Disease	Number of cases	Number cured	Days to cure	Success	
				Number of cases	Per cent
Subcutaneous abscesses	5	5	8		100
Pilonidal sinus	3		6	3	100
Mastitis		5			66
Inguinal lymphadenitis		3			
Aspirated abscess	5	3	5		

will be required sooner or later. It must be emphasized that the anti-cup is here is only one of the factors responsible for success. The removal of fibrin and expansion of the lung are just as important. If the lung does not fill in the dead space between visceral and parietal pleura fluid will always accumulate. At the slightest symptom of pus retention the wound can easily be opened and extensive drainage established. In case of success the avoidance of weary sinuses that eventually require further surgical treatment is very advantageous.

#### PERITONITIS

Katzenstein and Schulz have reported favorable results with rivanol irrigations and rivanol filling in cases of diffuse peritonitis. However, since the bacterial flora of peritonitis is very mixed and since the bacillus coli is especially resistant to rivanol too much can not be expected in this type of infection. After the removal of the infecting source the treatment of peritonitis should be general. Clostridia and large doses of quinine were given rectally. Irvanol was used in irrigating the cavity after a thorough removal of the pus but no conclusions can be drawn from our few cases. It is impossible to estimate the value of the drug in an infection of such varying course and in view of this combined treatment.

#### JOINT INFECTIONS

As Arthausen had demonstrated that a solution of rivanol 1:400 could be used on the normal cartilage of the rabbit with impunity concentrations of 1:500 were injected in cases of purulent arthritis. Again as in pleural infection it must be pointed out that sterilization of the joint cavity alone is not enough and only a combined treatment with precise indications can be advised. Only if the process is superficial such as purulent synovitis can chemotherapy be of value. For capsular phlegmon or perforated periarthritic phlegmon or abscess disinfection of the joint cavity comes too late. Aside from this anatomic consideration the mechanical removal of all fibrinous and necrotic tissue combined with perfect immobilization are equally important.

In an excellent article Tischer (29) advises the same principle of treatment as in pleural

infections that is if aspiration and filling with the antiseptic solution do not relieve the symptoms arthrotomy, complete removal of pus and fibrin rivanol filling and primary suture with drainage of the subcutaneous tissue are carried out. The functional end results are not influenced by the opening up of the joint if the drainage can only be avoided.

In our 5 cases this type of treatment proved very satisfactory. In 2 cases of pneumococcal empyema of the knee joint which had already been treated elsewhere with extension and rivanol filling incisions were made on the inner and outer edges of the patella pus and fibrin masses removed the joint filled with rivanol and the capsules sutured with catgut. Active and passive movements were begun on the eighth day. Flexion of 83 and 93 degrees was obtained in 3 months. Two cases of staphylococcal empyema resulting from pyemia were healed by three punctures and refillings which were made every third day. The fifth case was a very severe injury of the knee. The patella was fractured and there were particles of earth and pieces of clothing in the joint. The patient was seen 12 hours after the injury tetanus antitoxin was administered the wound cleansed necrotic tissue removed the patella sutured the joint closed and the whole region infiltrated with rivanol 1:1000. The patient developed a very severe periarthritic phlegmon although the cavity itself remained free from pus. Amputation was considered but extensive resection of the joint saved the limb. The knee of course was stiff. This case really belongs with another group of cases, preventive infiltration of accidental wound. The reason for the possible failure of this form of treatment will be discussed with that group.

All therapeutic efforts so far described belong to the group of cavity anti-sepsis and do not differ materially from the sterilization of wound surfaces. Abscess cavities and infected joints have long been injected with various antiseptic solutions such as tincture of iodine phenol camphor formalin glycine and many others. In the sterilization of wound surfaces Brunner regards many other drugs such as iodine alcohol Dakin's solu-

tion and chloramine as more effective. However in the treatment of localized infections the possibility of infiltrative antiseptics with these acridine dyes trypaflavine and rivanol is a new principle. Their injurious effect on the living tissue is practically nil.

#### PREVENTIVE INFILTRATION OF ACCIDENTAL WOUNDS

After the usual mechanical and chemical (iodine) cleansing of the wounds an infiltration of rivanol 1:1000 with 0.5 per cent novocain has been made as in local anæsthesia under and around the injured tissue. A culture was taken, necrotic tissue excised, visible dirt removed with hydrogen peroxide irrigation and primary suture made as a routine procedure in our out patient department. Tetanus antitoxin was administered at the same time.

Eighty one unselected cases were treated and so many factors were responsible for the end results that tabulation of these cases does not seem advisable. This preventive infiltration was a failure in 19 per cent of the 81 cases because the sutures had to be removed for progressive infection. Disregarding for the present the virulence and amount of the infecting organisms, the amount of destruction and the necessary reconstruction (tendon sutures and so forth) the condition of the blood and nerve supply, the defensive power and general condition of the patient, all of which play an important part in the healing of wounds, two main factors were recognized as having an unmistakable effect on our results: (1) the time which elapsed between injury and treatment and (2) the bacteriology of the wound.

The effect of the first was demonstrated during the War. Accidental wounds receiving definite treatment within the first 6 hours were primarily sutured and remained clinically aseptic in 89 per cent; wounds treated after the first 24 hours showed primary union in 46 per cent. As these patients were hospitalized and very carefully observed, primary suture was considered permissible unless an anaerobic infection was present.

This leads to the other important factor, the bacteriology of the wounds. As shown by

Brunner and Ritter in experimental and clinical observations, mono infections with streptococci or staphylococci respond very well to rivanol. In case of a mixed flora some influence on the infection can be observed, but it is not definite. Anaerobic infections are resistant to the usual concentration of 1:1000. A solution of 1:400 injected into the animal simultaneously with samples of highly pathogenic earth prevented an otherwise deadly tetanus infection (13) and so did trypaflavine and rivanol in powder form (9, 13).

As mixed infections in all probability containing anaerobes occur in all accidental wounds, preventive infiltrative antiseptics with rivanol cannot be advised as a routine procedure. The strongest concentration permissible in infiltrative antiseptics is 1:500, but in powder form concentrations as strong as 50 per cent do not interfere with granulations and the toxicity of the drug, as already stated, is slight. A 2.5 per cent rivanol powder made up with very finely divided carbamide has proved successful in sterilizing wounds in experimental staphylococcal infection (63) and in combating anaerobic infections. The use of urea (carbamide) as the base of a powder enables the disinfectant to penetrate much more readily into the deeper structures of a wound. The powder bases generally used, such as talcum or amylum, are insoluble in the wound secretion, agglutinate in lumps, form crusts and disturb regeneration. With carbamide an equal distribution of the drug is obtained and by virtue of its easy diffusion, chemical and osmotic indifference and the ease with which it may be applied, the drug seems very suitable for the prophylaxis of accidental wounds. No clinical results have yet been published regarding this form of treatment and only very large statistics will be of definite value.

#### PROGRESSING PHLEGMON WITH TISSUE NECROSIS

Morgenroth has been able to sterilize the connective tissue of the mouse in streptococcal and staphylococcal infection. Brunner did not get the same results and pointed out that conditions in man are much less favorable. In the loose connective tissue of the mouse, the

œdema spread rapidly on the forearm 6 centimeters in an hour. Serum was injected into the thigh in doses of 150 cubic centimeters every 8 hours yet the œdema continued to spread. Just below the axilla above the borderline of the œdema a circular infiltration of all layers from skin to bone was made with a concentration of rivanol 1:2000. A slight swelling followed this procedure. The œdema stopped at the point of this infiltration and the patient recovered. The other patient had a pustule on the hair line in the temporal region a shaving brush infection. The œdema spread over the ear down to the neck and into the loose tissue of the eyelids. At the site of circular infiltration the œdema stopped.

No definite explanation of these results can be given. The sporicidal action of rivanol is very slight (15) but an inhibition in growth a decrease in the virulence and an antiseptic sealing off of the lymphatics may have prevented further generalization. Once the organism has been localized and weakened the host seems to be able to throw off the infection by itself. The same principle as in the treatment of erysipelas may be observed here an antiseptic preventive infiltration of a slowly resorbable drug (64) which has more chance to act than if it were injected into the infected tissue.

Favorable results have been reported with rivanol in dentistry (1, 22, 32, 34) dermatology and urology (36) chronic gynecologic infections (31) ophthalmology (43) and veterinary medicine. No attempt has been made to review the literature as I have had no personal experience in these fields.<sup>1</sup>

#### DISCUSSION OF CLINICAL RESULTS

In view of the various factors that influence the course of infection in man clinical results

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must be weighed with great caution. It seems from reports in the literature especially Brunner's admirable studies and from our own observations that rivanol in the concentrations used 1:500 in cavities 1:1000 to 1:2000 in infiltration of tissues does not destroy the tissues and has an elective affinity for streptococci and diphtheria bacilli (26, 58). Staphylococci are not so susceptible to rivanol but are markedly influenced. *Bacillus coli* and pyocyanus are very resistant. The concentrations used in infiltrative antiseptics are insufficient to combat anaerobic infections but strong solutions of 0.5 to 1 per cent or the drug in powder form applied on the surface of the wound will save the animal from death (15). Another limitation of efficiency is seen in the presence of necrosis. If necrotic material can be removed by surgery or if antiseptics is established before its appearance optimal conditions are present.

A direct antimycotic action of these dyes cannot be denied as is best indicated by their elective affinity for certain organisms. An absolute disinfection in the tissue a condition which is scarcely conceivable is not essential to clinical results if the virulence is decreased and the poison fixed by rivanol diphtheria toxin could be neutralized by rivanol (38) the defensive power of the patient will then overcome the infection. It is the great merit of Morgenroth to have given us an antiseptic which can be used not only intravenously and on the surface of wound but also in human tissues by means of local infiltration.

#### SUMMARY

Chemotherapy was originally a treatment of infection with chemical agents that had a specific action on the infecting organism. The rôle of the host was disregarded in this original conception but has gained more and more importance. It is now realized that the direct disinfectant or inhibitory action on the parasite must never suppress the defensive power of the host. Several facts are mentioned which prove an active cooperation on the part of the host.

The direct disinfectant or inhibitory concentration of a drug as shown in the test tube can serve the purpose of initial orienta-

tion but the value of animal experiments acting as living test tubes are beginning to be fully recognized. The absolute disinfective index of a drug is the ratio between its disinfectant concentration *in vitro* and its disinfectant concentration in the living tissue. The ideal index is 1:1 that is the antiseptic properties of the drug are not inhibited *in vivo*. Other methods of experimental evaluation in the living tissue are described.

As a member of the group of acridine dyes 2-athoxy—6-9-diamino acridine (rivanol) was synthesized by Morgenroth in 1921. A physical, chemical and pharmacological description of it is given. The antiseptic index is 1:5 for streptococci and more than 1 for staphylococci. Rivanol therefore has an advantage over trypaflavine. Rivanol is also much less toxic and more slowly resorbable than the latter and is therefore especially suitable for local antiseptics.

For clinical use the concentrations varied from 1:500 to 1:2000. In tissue infiltration 0.5 per cent of novocain without adrenalin was added.

Localized abscesses were healed by a few punctures if the necrotic tissue could be removed through small stab wounds. Course, duration and cosmetic effect were favorable. Glandular abscesses like mastitis, lymphadenitis and hydradenitis do not respond well to this treatment because of the large amount of necrotic tissue.

The rivanol treatment of pleural empyema and of joint infections is based on the same principle: removal of all necrotic tissue and fibrinous masses and water tight closure of the cavity itself with ample drainage of the subcutaneous tissue. The sterilization of the infected cavity is only one factor in obtaining the desired result. The indications for this closed therapy are naturally limited.

Peritonitis was treated with rivanol irrigations but no conclusions can yet be drawn as the number of cases is too small.

Prophylactic infiltrations of accidental wounds show that mono-infections of streptococci and staphylococci can be treated with primary suture especially if the treatment is instituted early. Anaerobic infections are a contra-indication to this treatment. Wide ex-

posure of all pockets, peroxide and iodine alcohol and eventually rivanol infiltration are advised as local treatment by Brunner. The use of 2.5 per cent rivanol with carbamide powder in wound prophylaxis seems experimentally sound and deserves a trial.

The results in cases of progressive phlegmon with tissue necrosis, infections of the hand, carbuncles and furuncles were not satisfactory although it was possible to arrest the process.

Excision and primary suture of furuncles under a defensive wall of antiseptic anaesthesia were successful in a few cases.

In erysipelas a circular intradermal and subcutaneous ring around the inflamed area had a definite effect on the process. Being a streptococcal infection generally without necrosis the success of the treatment is well based on experimental findings.

Rapidly progressing cutaneous anthrax was arrested in two instances by circular infiltration with rivanol.

Favorable results have been reported in various specialties.

The chief value of rivanol then as seen in clinical observation aside from the possibility of sterilizing infected cavities by a non-toxic and non-caustic chemical agent is the building up of an antiseptic wall between focus and general circulation by means of circular infiltrations around the progressing infection. No doubt clinical agents with a more universal action against bacteria will be found but Morgenroth deserves great credit for proving that tissue antiseptics in the prevention and cure of localized infection is practicable.

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## SOME DEBATABLE POINTS IN THE SURGERY OF THE GALL TRACT

BY WILLIAM D. HICCARD, M.D., F.A.C.S., NASHVILLE, TENN.

**I**N the perfection of the surgery of the gall tracts the most debatable point has been the indication for removal of the gall bladder. Out of 345 cases of gall bladder operations in our clinic (1919-1933) exclusive of stone in the common duct, 297 were cholecystectomies. Approximately 85 per cent were removed in total or drained. In 70 per cent gall stones were present. The mortality in the combined series was 4.04 per cent.

It is notorious that cholecystotomy in the absence of stone gave very unsatisfactory results. It is estimated by Bancroft that only 50 per cent are cured and in the hands of many surgeons cholecystostomy in the unbenched is often followed by a secondary cholecystectomy.

The majority of gall bladder infections with or without stone are frank and satisfactorily diagnosed.

In some cases the symptomatology is not attended with definitely recognizable pathology. In the usual case upon exploration the gall bladder either contains stones that are easily palpated or the gall bladder is thickened or surrounded by adhesions.

It may have deposits of subperitoneal fat and no stones may be palpated. A normal gall bladder is blue but a blue gall bladder is not always a normal gall bladder. Under certain circumstances one may have to open the gall bladder to make a diagnosis. Occasionally very small stones are found when it was not possible to palpate them through the gall bladder wall. Again we find the typical strawberry gall bladder which requires removal. Characteristic of the strawberry gall bladder is the small elevated whitish area caused by a deposit in the mucosa of an ester of cholesterol which lipid substance when sufficiently deposited is to be discernible by the naked eye has a fanciful resemblance to the strawberry seed.

If however the lining membrane appears normal one hesitates about removing the gall bladder and dislikes more to drain it. It is

certainly unwise to drain a gall bladder that is not bad enough to take out in the absence of stones and in the absence of any mucosal change. A section of the wall has been removed by Judet for pathological examination. He refers to occasional cases in which the pathological changes were not recognizable and the incision was closed without removal. A few such cases had continued symptoms apparently requiring another operation with relief. We can hark back under those circumstances to the old operation of cholecystostomy or immediate closure of the gall bladder. If we make a wrong diagnosis it is not necessary to remove the gall bladder to support the diagnosis. Crile contents himself with making the decision by inspection and palpation. Unless convinced of demonstrable pathology he does not open, drain or remove gall bladder.

It is probable that small stones form in the mucosa as a result of these cholesterol deposits. It has been experimentally proved by Drury and others that cholesterol precipitation in human bile can be induced or prevented by lightly altering the reaction of the fluid toward the alkaline and acid sides respectively.

The last 100 autopsies in the Mayo Clinic showed diseases of the gall bladder either macroscopic or microscopic in 4 per cent. Hubbard found that in 46 autopsies on bodies in which gall stones were revealed 65 per cent died as a result of their presence from such complications as empyema of the gall bladder, acute pancreatitis, etc. Fifty per cent in which stones in the common duct were found died from the condition.

## FOCAL INFECTION

Local infection has made a signal advance in prophylactic medicine as well as in its therapeutic use. It has not been indisputably proved. We are prone to give to each new theory more credit than it finally holds. The intriguing theory of Posenow relative to the selectivity of microorganisms when they emigrate

grate from their habitat is most far reaching. From the original focus the gall bladder is believed to be infected and later the infection is relayed to other organs. It is emphasized by W. J. Mayo that certain forms of cardiac diseases are very closely associated if not caused by gall bladder infection. He refers to the heart lesions of adolescence which in the presence of gall stones are very strikingly relieved by their removal. There is little danger in this type of noisy heart associated with chorea. Mayo said he had never seen a surgical death result in these circumstances. Attention is called to essential hypertension. Hypertension due to many causes is very frequent in women of overweight who have gall stones and they are markedly improved as to their hypertension by operation for the gall bladder infection and without much danger so far as death from hypertension is concerned. Syphilitic aortitis is believed by him to be frequently associated with angina and when gall stones are present the angina seems to be greatly benefited by operation without much danger in spite of the angina. Willis in the Mayo Clinic noted coronary sclerosis associated with disease of the gall bladder in 24 per cent. The cardiorenal type and the toxic variety of heart disease apparently have no relation to gall stones. The arthritides which are due to focal infection particularly from the gall bladder are most satisfactorily cured by removal of the cause which also may be said of certain forms of muscular rheumatism.

The relationship between gall stones and appendicitis has been stressed by Moynihan and Mayo has recited very striking examples of simultaneous acute infections and perforation of the appendix and the gall bladder. Surgeons generally agree that if feasible it is wise to remove all appendices with any evidence of pathological change during operation upon the gall bladder.

The relation between gall stone and pancreatitis is well known and inasmuch as it is the resulting complication and pancreatitis is such a murderous disease it is a very positive and very valid argument for early operation in gall bladder infections and calculus. Acute pancreatitis resulting in many cases

from stone in the ampulla of Vater allowing retrojection of bile direct through the duct of Wirsung causes the most dramatic syndrome in all medicine. Reginald Fitz has very graphically described it. When an elderly man previously well or an occasional sufferer from indigestion is suddenly seized with a severe agonizing epigastric pain associated with vomiting followed by collapse and within 24 hours with a fluctuant epigastric tumor acute pancreatitis may be diagnosed. The diagnosis is usually that of intestinal obstruction and because of the vomiting obstipation and great pain prostration and death will follow if patient is not relieved. It is not to be understood however that the subacute type of pancreatitis even with hemorrhage the apoplectic variety or with fat necrosis is necessarily fatal even without operation although these cases do remarkably well when the gall bladder stones are removed and the gall bladder drained. The gall bladder should never be removed if there has been any jaundice or other evidence of obstruction in the common duct. The gall bladder may subsequently have to be utilized to sidetrack the bile either to the stomach or to the duodenum.

Relationship of chronic biliary cirrhosis caused by infections of the gall bladder especially following stone in the common duct as described by Adams is no longer debatable. Moreover removal of the cause is very beneficial unless too much connective tissue has been deposited around the bile radical to prevent complete cure and cause slight jaundice more or less permanent.

*Association of hepatitis with cholecystitis.* Graham has very beautifully shown that infection of the gall bladder is probably secondary to infection of the liver. Hepatitis comes from the portal circulation and is transmitted to the gall bladder by way of the lymphatic connections between the two organs.

Heyd believes inflammation of the liver leading to fibrous thickening of Glisson's capsule comes from severe inflammation in the region of portal drainage most common about the appendix and extends from the liver to the gall bladder either through the bile or through the lymphatic channels and the cholecystitis thus initiated may subsequently in

its repeated exacerbations bring about localized or even general hepatitis by lymphatic extension of the infectious process

Strachauer suggests that when one is unable to decide definitely at operation from the physical signs what is the condition of the gall bladder a small section of the liver be examined under a frozen section and that if evidence of hepatitis with round cell infiltration is present the gall bladder be removed in order to eliminate the vicious circle

Relationship between gall stone disease and glycosuria is fairly definite Diabetic pancreatitis patients can be very satisfactorily prepared for operation with insulin and give a fair degree of assurance that the sugar will permanently disappear in some cases

The method of determining the liver function with phenolsulphonephthalein introduced by Rosenthal is based on the ability of the liver alone to remove the dye from the circulatory blood in a given time

Under conditions that are normal the dye leaves the blood rapidly but when there is dysfunction of the liver it is retained and is very high for several hours This degree of retention in the blood gives a very definite indication as to the severity of the disturbances in the liver A retention as high as 8 per cent at the end of 15 minutes is considered normal One of the greatest advantages of this test of Rosenthal's is in those cases in which there is no obvious liver dysfunction and there are no clinical evidences of any disease of the liver This is the type of case in which a liver function test is of great importance as an aid to diagnosis and a guide to therapeutic management

Some cases of chronic cholecystitis showed a moderately severe dysfunction about 2 per cent of the dye being present at the end of 4 hours Cirrhosis gives the highest percentage of retention It is obvious that there is a real value in this test of liver function

Charles Gordon Heyd has graphically described three types of deaths that occur after operations upon the gall bladder or ducts and that cannot be explained by surgical trauma or shock sepsis gastric dilatation or kidney insufficiency These he attributes to hepatic insufficiency Type one is a case that goes

into profound vasomotor depression at the end of 24 or 36 hours after a cholecystectomy without apparent reason The patient's skin becomes cold clammy moist and leaky There is mental stimulation These cases usually respond to the intravenous administration of glucose and tap water proctoclysis every 4 hours He interprets this as being due to some pancreatic toxin or ferment following surgical trauma that the liver handles inadequately Type two is a progressively developing coma which usually comes on 4 or 5 days after a relatively simple gall bladder operation in the chronically jaundiced individual and usually terminates fatally with high temperature in 12 to 48 hours Type three is less frequent and usually occurs in patients with a long history of gall bladder or duct infection They pass into a coma immediately after the operation with high temperature rapid pulse and mental excitation and chemical analysis shows an alkyllosis Heyd has been able to save his last two out of six cases by the internal administration of dilute hydrochloric acid We have all seen these desperate stormy terminations to an apparently successful operation and at postmortem have been unable to find sufficient evidences to justify any explanation other than liver insufficiency

#### X RAY DIAGNOSIS OF GALL STONE

This question has been very thoroughly discussed and still the difference between the most enthusiastic advocate and the most pessimistic is quite wide and even the most conservative shows that about 52.9 per cent positive report of disease is correct in X ray studies and a negative diagnosis in 44 per cent in which the pathological evidence was varied from the mild to the most extreme grades of disease according to Carman and McCarty Fewer than one half of the cases of diseased gall bladders were revealed by the X ray They say that about 38.4 per cent of gall stones have been revealed by the X ray but that even typical shadows with the denser circle around the periphery may be confused with a dozen or more circular shadows of which kidney stones and calcified areas in the structures near by are the most frequent The

shadow of a pathological gall bladder is still more elusive of determination. Unless the liver and kidney outline can be identified accurately no shadow should be regarded as satisfactory definition. When these are isolated the third shadow anywhere between the tenth rib and the crest of the ilium may be a diseased gall bladder. However Carman enumerates fourteen other conditions casting shadows that may simulate the elusive gall bladder such as the upper pole of the kidney, an enlarged caudate lobe of the liver, an unusually broad twelfth rib, food in the hollow viscera, etc. Nichols has shown 75 per cent of stones in the Cleveland Clinic.

The indirect evidence such as deformities of the stomach and duodenal cavities and of the antrum of the stomach, hepatic flexure, plastic phenomena and filling defects in the viscera, abnormalities of motility is even more nebulous. However Case found 88 per cent positive in these indirect signs. On the other hand George and Leonard say if only one minor type of indirect evidence is present it is questionable.

X ray visualization of the gall bladder by circulation injection of the sodium salt of terabromphenolphthalein (Graham and Cole) is a helpful addition. The dye causes a shadow of the gall bladder reaching its greatest intensity in from 8 to 24 hours and disappearing in 48 hours. Interference with filling and hence no shadow suggests obstruction due to gall stones or other pathological conditions. Unvarying size indicates loss of elasticity, mottling of the shadow suggests stones or papillomata.

In 25 cases of gall stones Carman found the dye of conspicuous service in all but two and of 39 positive cases subsequently operated upon 36 had given definite abnormal responses. Cirrhosis may prevent secretion of the dye and no shadow is cast.

Biliary obstruction when known to exist is contra indicated on account of the severe reaction with nausea, vomiting and prostration like a vasomotor shock continuing sometimes for 8 or 10 hours with a fall in blood pressure.

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The test requires hospitalization for a day, the films are made at the end of 5, 8 and 24 hours.

Graham has employed it in about 100 cases and Carman in 200 cases. The former (personal communication) says like any other X ray examination the most important question is the interpretation of the plates. Carman is of the opinion that if the reaction following the injection of the dye is overcome the method will be comparable to the use of barium in the diagnosis of diseases of the gastro intestinal tract.

Graham thinks that the reactions can be reduced by the use of freshly distilled water in making up the solutions.

#### HISTORY

Nothing is superior in diagnosis to a well taken and carefully recorded history. Of course an X ray demonstration of stones is indisputable if positive but when negative means nothing and often stones are present when too soft to show shadows. Attacks of colic may be followed by a certain type of indigestion between spells or with periods of comparative health. Again there may be stomach trouble as the most conspicuous symptom with occasional gall bladder attacks or the entire symptomatology may be ostensibly gastric. Intervals of freedom from pain are very suggestive of gall stones whereas it is well known that in malignant disease the symptoms are either constant or increasingly severe and over a relatively short period with little or no improvement. Deaver in his picturesque way paraphrases the classic description of the gall stone patient as fair, fat and forty with belching which is of course most significant. As scarlatinal infections are to nephritides so gall bladder inflammations were formerly thought to be dependent upon typhoid. With the great abatement of typhoid however gall bladder infections are not decreasing.

#### ACUTE CHOLECYSTITIS

The rarity with which patients ever die from acute cholecystitis when left alone should compel us to avoid operation in the acute stages which is notoriously dangerous. The

exception to this might be in the two extremes namely in the very beginning of an acute attack before pathological changes make the operation at all difficult and in the severe gangrenous type in which the gall bladder should be removed. Even the cases however are better left until nature isolates the gall bladder by adhesions and an operation can be done secondarily at the end of ten days or two weeks better than it can the first four or five days.

In the preparation of jaundiced patients for operation the technique of Walters of the injection of 5 to 10 cubic centimeters of a 10 per cent solution of calcium chloride in water injected intravenously every day for 3 days has a very decided influence in increasing the coagulability of the blood and lessening its clotting time. It seems to be non toxic and is practically eliminated in a few hours.

The danger of serious and sometimes fatal oozing in operations on the jaundiced is very greatly reduced especially if it is combined with blood transfusions in suitable cases. It is not to be supposed however that it is an absolute preventive. I have known of two cases in which after this preparation death ensued from hemorrhage one on the sixth and the other on the seventh day from removal of a drain in one case and from a small decubitus ulcer on the anterior lobe of the liver where it came in contact with the incision that oozed fatally in the case of one of my colleagues filling the abdomen with blood. It is important therefore to watch the coagulability each day after operation to supplement the so called therapeutic course in the prepara-

tion of the case by subsequent instillations of calcium chloride with or without blood transfusion. The patient is not safe therefore from secondary hemorrhage at the conclusion of the first few days after operation. Crile has reported a case with fatal secondary hemorrhage in spite of massive transfusions and calcium chloride.

#### STONE IN THE COMMON DUCT

While it is possible and becoming more common to operate for stone in the choledochus during the attack even in the presence of jaundice it is however generally speaking better to tide the patient over the attack particularly if the jaundice shows any evidence of subsiding and operate in the interval. That was the old rule and a very good one. With the improvement in results and especially the ability to prevent secondary hemorrhage by newer methods with the use of calcium chloride the operation can be performed now with greater safety. It is wise however not to remove the gall bladder while a patient has jaundice. Drainage is very essential and the gall bladder is utilized for that purpose together with an independent drain at the site from which the stone is removed from the common duct.

In the bad cases drain the gall bladder and leave the stone in the common duct as urged by Crile just as in the two-stage operation we drain the urinary bladder and leave the obstructing prostate. Biliary obstruction with resulting liver insufficiency is similar to kidney insufficiency from prostatic obstruction. Decompression is the primary indication in both

## INJURIOUS INFLUENCE OF THE USE OF THE ULTRAVIOLET RAY ON OLD X-RAY BURNS

By L. L. McARTHUR M. D. F. A. C. S. CHICAGO

**B**ELIEVING as I do that the general surgeon as well as the general practitioner has held in the past an altogether too complacent opinion of the innocuousness of the ultraviolet ray regarding it as a scientific plaything with mild potentialities for good I deem it my duty to report and demonstrate at this time the disastrous influences the ray may sometimes wield. This appears to me to be the more imperative since the experiences and teachings of those most familiar with its therapeutic values are diametrically opposed to the deductions to be made from this case.

Careful search in the literature reveals the general consensus of opinion among radiologists that the ultraviolet ray is the complement (therapeutically) of the X ray that while the X ray produces a late burn (7 to 15 days) the ultraviolet does so in 24 to 48 hours that the use of the ultraviolet ray following an X ray treatment will ameliorate or even prevent an X ray burn and so its employment is recommended that while the X ray is destructive in its influences the ultraviolet is constructive that while the large dose of X ray destroys the red blood cells and lowers the white count (sometimes to 1500) the ultraviolet ray improves both the number and character of reds and induces a leucocytosis as high as 15 000 to 18 000 that while the X ray acts as a depilatory rendering an area often permanently denuded of hair the ultraviolet may convert even the delicate lanugo into a strong pigmented growing hair.

Even granting that these claims have been demonstrated many times in many hands there yet remain several incongruities in the further claims for the potency of the ultraviolet ray which nullify in part the above contentions and leave one in doubt as to its innocuousness. Thus Potthoff has shown that the ultraviolet ray has a most decided bactericidal effect for by exposure to the direct rays he has proven their ability to kill

pathogenic germs in 18 to 60 seconds some common saprophytic germs in 3 minutes and even the spore bearing ones in 7 minutes. Can a light so destructive to these be wholly innocent to the almost equally fragile human cell?

If the average drinking water can be rendered safe and potable by flowing down a trough over a series of rills subtended by ultraviolet lamps can we count with safety on absence of injury to the tissues of the human body similarly exposed? That we cannot has been *disastrously* demonstrated by those rendered blind through the unprotected influence of these rays upon the lens inducing prematurely senile cataract upon the macula inducing atrophy as in the case of movie actors and actresses eyes subjected to the concentrated effect of numberless mercury vapor lamps used in their studios.

Physically the ultraviolet rays are closely allied to the roentgen rays (also a form of light). Ever shortening from beyond the ultra red wave length in which as in the wireless they may be miles in length down through the spectrum color scale with 12 000 Angstrom units for the red to the ultraviolet with 1800 units we come to the radium rays and finally the infinitely short wave lengths of the modern high voltage Coolidge tube emissions. Knowing how closely together these three lie in their light source are we not compelled to regard them with proportionate suspicion of their dangerous potentialities?

Just as by trial and error we have arrived at a reasonably safe control of the X ray in its usage should we not by this trial and error on the human being take advantage of its lesson and regard less complacently the indiscriminate use of a wonderful force for good when intelligently controlled?

A brief history of a case in point follows.

Dr. C. P. admitted to St. Luke's Hospital (No. 142459) Chicago September 14 1920 age 42 years

dentist. On December 8, 1919, while at work at his profession, patient drove into his little finger (right hand) and broke a steel drill. He sought immediate removal of the fragment from the little finger by a surgeon who made an effort under the fluoroscope to remove it. It is estimated 25 to 30 minutes were occupied in the procedure. Eleven days later a severe X-ray dermatitis developed extending from the middle of the forearm to the dorsum of the hand and to the third, fourth and fifth fingers over the inner half of the back of the hand over the tendon of the ring and the little fingers. There remained on May 25, 1920, a circular area of white gangrene 2 centimeters in diameter. At this time, nearly 6 months after the exposure to the X-ray, patient was induced by a friend to have the ultraviolet ray used. This was done May 25. One week later a similar exposure of 5 minutes at 6 inches distance was again made. The conditions becoming decidedly worse, the patient refused further treatments and continued those applications that he had been using from the beginning of the X-ray burn, such as Dakin solution, emollients and occasionally when the pain was too distressing a few drops of a 4 per cent novocain solution. Nothing of especial interest appears in the history of the patient as bearing upon this condition.

Patient was 42 years of age, had 4 children, no family history of tuberculosis or cancer, was a

moderate smoker, had no venereal history and no severe previous illnesses. At the time of admission to the hospital his hand presented an alleged X-ray burn with white gangrene of right hand from middle out extensor tendons of little and ring fingers gone, contractions of the fingers and extension of the burn halfway to the first joint from the back of hand on these fingers and on the inner side of the middle finger.

On September 18, 1920, the destruction of the fourth and fifth fingers was so great that it was decided to amputate them and save enough flap to cover the articular ends of the third and fourth metacarpal bones. The gangrenous area was dissected off the back of the hand down to the periosteum as the tendons had already sloughed. The burn on the inner side of the first phalanx of the middle finger was likewise denuded and Thiersch grafts applied. At the end of 10 days it was found that these grafts had failed to grow on the area of such lowered vitality. It was therefore determined to make a pedicle graft from the right abdominal wall covering two thirds of the back of the hand with a flap turned up from the right hypogastric region of the abdomen; the pedicle containing the main branch of the superficial gastric artery. At the end of 18 days this flap was detached from the abdomen and remained lying on the dorsum of the hand—a satisfactory covering to the raw surface.

# DEPARTMENT OF TECHNIQUE

## RHINOPHYMA

A REPORT OF SIX CASES CURED BY RADICAL OPERATIONS FOLLOWED BY X RAY AND ACID TREATMENTS TO RELIEF THE ASSOCIATED HYPERTROPHY OF THE SKIN AND TO REDUCE THE OPERATIVE SCARS TO A STATE OF INVISIBILITY.<sup>1</sup>

By JAMES FRANCIS CRATTAN M.D. NEW YORK

In the fall of 1919 the writer had the opportunity of performing an impromptu operation in a case of rhinophyma without the ordinarily necessary formality of consulting text books or surgical authority concerning the technique necessary to effect a reasonably good result. In short on 3 hours notice without preparation a radical excision and subsequent plastic reconstruction was attempted. Perhaps the lack of time for consulting the case reports of men who had handled these cases according to the French and Italian technique of enlaid decortications with subsequent skin grafting caused through necessity the invention of a new radical procedure which allowed the removal of the tumor and the reconstruction of the nose to normal contour in one operation. The follow up treatment with the X ray alternating with applications of trichloroacetic acid resulted in the leveling of the skin of the nose and adjacent areas of the cheeks and to the surprise of all concerned eliminated the visibility of the operative scar.

The complete report of this first case with the technique of the operation and of the X ray and acid treatments has been published.<sup>2</sup>

CASE. M. C. a man aged 43 single dated the in the change in the tip of the nose to the tenth year when he said the end of the nose was severely lacerated by a dog bite. He did not realize whether or not there was infection present at that time. At 1 year the patient had facial palsy in closing the cheeks, eyelids and nose. The tick kept him in bed for 2 weeks. During his youth he sustained several blows to the face. He had a second attack of facial erysipelas. The encephalitis to which he was subjected in childhood was the local cause of the repeated tremors and infarction of the brain in the gaseous secretion which reassociated the parietal and tumor growth.

Physical. The patient is of medium build, deformed by nasal deformity, slightly with the deformity of the nose. The nasal deformity is globular, more about 1 inch in diameter, tapering to the alar base. The alar base is broad and the metacarpal of the nose is distended upon the alar base. The junction of the middle and the third finger and the

J. Am. M. Ass. 9, 1920



Fig. Case from front and profile photographs before and after operation.

Read before the New York Academy of Medicine, October 9, 1920, as part of the monthly meeting. Plastic Surgery, 11th Fac.





Fig 2 Case 2 before and after operation

lately to the anterior border of the alar nas. Chr. c. f. m. l. (m. d. d. b. e. s. y. t.) d. t. t. d. the skin over the entire tumor surface a fine l. d. th. k. of the t. f. th. a. d. th. adj. c. nt. parts of the h. e. k. Th. l. d. t. th. l. l. t. rat. Th. skin of the tumor is leathery and firmly attached b. t. f. r. m. a. c. l.

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Fig 3 Case 3 before and after operation





Fig 6 C e b f r e a n d f t e r o p e r t n

**Local anesthesia** A 4 per cent sterile novocain solution was packed into either nostril on dental cotton rolls. 4 per cent novocain was injected around the nose beginning at the columella and extending laterally across the base of each nostril along the outer border of either ala and upward from those points and across the middle of the nasal bones. To supplement this the supra-orbital nerves and the middle branches of the trigeminal nerves were blocked off at their emergence. The skin was infiltrated along the lines of excision of the separate masses of tumor tissue.

**Operative technique** Curved incisions were made slightly above the line where each tumor mass began to show above the estimated level of what was intended to be the final level of the reconstructed nose. Enough skin from around the base of each tumor must be saved to cover the raw areas left after excision of the mass.

**Reconstruction of the nose** In each case more than ample skin remained for covering the areas left by the excisions of the tumors and after being trimmed the skin edges could be approximated and sutured without tension.

**Dressing** One per cent iodine in glycerine was painted over the suture line and aristol powder was dusted over the entire nose. Vaseline gauze was applied and dry gauze over that with adhesive straps.

The average hospital stay was 3 to 4 days. Complete healing occurred in all cases within 10 days; the sutures were removed within that period as indicated by loosening.

**X-ray and acid treatments** After two X-ray treatments of 4 unit at weekly interval including 4 unit each time to the entire face to clear up the remains of the general acne, 50 per cent trichloroacetic acid was applied to the elevated areas at the end of the third week. The scabbing

from this application usually required 6 to 7 days for completion. A pink area remained after the scab separated itself for about 4 to 5 days. This was replaced by the normal color. Subsequent repetitions of the X-ray and the acid application were guided by the necessity of the case in each instance. The entire time required for the elimination of the irregularities and the scars of the operation varied from 3 to 5 months. When the patient was willing to continue until a practically ideal condition of the skin of both the nose and the face was obtained, this period was extended. The good effects of this persistence is illustrated in the photographs of Cases 1 and 3.

#### SUMMARY

1 Rhinophyma is a condition curable by surgery, X-ray and trichloroacetic acid (triple technique).

2 The older technique of decortication and skin grafting from distant points seems no longer necessary and does not give the satisfactory results illustrated by the 6 cases outlined.

3 The disfigurement due to these growths is a personal, social and physical handicap to the unfortunate patient and the one suffering with such deformity deserves to have the benefit of a radical attempt at elimination of the growth.

4 Gradual destruction of rhinophyma by the high frequency current seems a laborious task for both patient and operator as compared with the results of the surgical technique.

5 The use of flaps demonstrated in the 6 cases herein described gives a satisfactory primary result without necessity of secondary skin grafting.

6 The postoperative use of the X-ray and trichloroacetic acid reduced the irregularities of the skin and rendered the operative scars practically invisible.

## UMBILICAL ARTIFICIAL ANUS

By A. L. SORESI, M.D., NEW YORK  
 Assistant Surgeon, Greenpoint Hospital, Brooklyn

**F**AST rules cannot be laid down regarding any surgical procedure and while the left iliac region has been the chosen location for a permanent artificial anus it seems to me that in properly selected cases the umbilical region is a more suitable location. My clinical experience in using this region is limited to two early cases one of which was operated upon with satisfactory results at the Greenpoint Hospital during the latter part of October 1924.

When the umbilicus itself is dissected away the umbilical region presents a roundish shape which conforms to the contour of the bowel and forms a well fitting receptacle for the implantation of the bowel. The fact that the umbilical region is located in the middle of the abdomen and presents a natural depression makes the wearing of a protective apparatus very effectual and comfortable. I am able to appreciate this one need but recall how difficult and uncomfortable it is to hold any protecting device to the curves of the iliac region.

The greatest advantage of this region for an artificial anus however I believe lies in the practically perfect control of the passage of feces. This control is obtained by surrounding the artificial anus with uninjured muscular fibers from the border of both recti muscles in such a manner as to constitute an effective sphincter. We emphasize the importance of surrounding the bowel with uninjured muscular fibers because in any other procedure the muscular fibers that surround the bowel are split torn or cut consequently the blood and nerve supply of the muscular fibers are certainly more or less damaged thus rendering the muscles less efficient. In the method proposed the muscular fibers that surround the bowels on all sides are absolutely uninjured and therefore completely efficient.

The technique used is as follows. The umbilicus is dissected away by an elliptical incision following the line shown in Figure 1. This incision removes about 3 or 4 millimeters of superficial fascia all around the umbilicus leaving exposed a corresponding amount of the muscular fibers of the external borders of both recti muscles. On the linea alba (Fig. 2) for 1 centimeter above and 1 centimeter below the umbilicus the external borders of both recti muscles are also exposed. This is done by splitting the linea alba and removing about 3 or 4 millimeters of the superficial

fascia as was done around the umbilicus. The deep fascia and the peritoneum are cut close to the external borders of the recti muscles. The end of the bowel is passed through the opening resulting from the dissecting of the umbilicus and allowed to protrude a few millimeters. The peritoneum and the posterior fascia of the recti muscles with all its structures that surround the umbilical region are secured to the serosa of the bowel with a continuous mattress suture made with catgut No. 0 or 1. Care must be taken to evert well the peritoneum so that it is properly approximated to the serosa of the intestine. A second continuous suture made also with catgut No. 0 or 1 secures the external fascia of the recti muscles to the serosa of the intestine. A third row of continuous suture approximates the skin to the bowel. Care must be taken to preserve the blood supply to the mucosa. Therefore these sutures should be very superficial the needle entering only the serosa and muscularis respecting the submucosa and the mucosa. The two incisions made on the linea alba above and below the umbilicus are also closed with three rows of sutures. The deep suture approximates the peritoneum and the deep fascia. The middle suture approximates the superficial fascia of both recti. The external suture approximates the skin.

The bowel should fit closely and snugly around the edges of the recti muscles (Fig. 4). Attention is called to the special manner of incising the superficial fascia away 3 or 4 millimeters from the external borders of the recti muscles. By so doing and suturing the superficial fascia to the bowel the muscles are forced to bulge around the bowel and thus form an efficient sphincter. The bowel

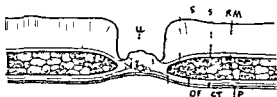


Fig. 1. Umbilical region showing the elliptical incision made about 3 or 4 millimeters from the superficial fascia all around the umbilicus. S, Skin; F, superficial fascia; P, peritoneum; U, umbilicus. (From T. Tuttle's "Anatomical Diagrams.")

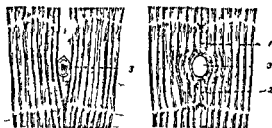


Fig. 3. Umbilical region. S. p. fic. l. f. sci. ha. g. b. n. rem. ed. with t. c. s. th. linea alba. abo. t. i. c. t. i. m. t. l. g. bo. e. d. below th. umbil. 1. and 2. Lan. a. alba. abo. e. nd. bel. w.

Fig. 3. Umbil. h. w. g. line of i. i. s. bo. t. cent. met. l. g.

Fig. 3. Schem. t. c. w. b. ing. how. m. scul. fibers. h. ld. ound. th. bo. elon. all. d. s. St. t. hes. are. shown. se. tering. the. m. sc. l. fibers. Th. s. i. done. to. sh. w. th. t. sh. ld. pp. imate. the. m. c. l. fibers. t. the. bo. l. St. sh. ev. m. t. t. ter. th. n. cul. fibers. but. nly. th. fa. a. i. d. 2. L. lba. r. m. d. l. pp. m. t. o. f. m. cular. fibers. t. j. bow. l.

should fit rather snugly around the surrounding tissue just as does the natural anus.

It is necessary to emphasize that the sutures should enter only the peritoneum and the deep and superficial fasciae never the muscular fibers. Also when the peritoneum is being sutured to the intestine deep fascia must be included. If the deep fascia is not included the muscular fibers will not be in close contact with the intestine and the sphincteric action will be hampered by the formation of an excessive amount of connective tissue. The muscular fibers must surround the bowel (Fig. 3) on all sides and be held in position only by the fasciae to which they are attached and their vitality and efficiency should not be hampered by sutures or excessive connective tissue.

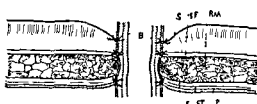


Fig. 4. Cross section of umbilical artificial anus showing 3 rows of sutures. Note how muscular fibers bring gain to be el. S. Sk. n. S. F. R. M. D. F. C. T. P. 1. Fig. 4. B. Bo. el.

We do not enter into any details of surgical technique indispensable to the establishment of an artificial anus and therefore familiar to all good surgeons. We shall however remark that the longer the loop of colon behind the new anus the better. Also that the loop of intestine must be free from any tension. To obtain a free loop at times it might be advisable to free the colon from the parietal peritoneum.

#### CONCLUSIONS

I believe that the umbilical region presents many advantages over any other for the location of a permanent artificial anus on account of its superior sphincteric action and the comfort which results from adapting to this region a protective device.

We do not claim that an artificial anus located at the umbilical region is a blessing because at the best an artificial anus is always little less than a curse. We think however that it is our duty as surgeons to strive to make this necessary evil as little damnable as possible by giving the patient the benefit of any ingenious device we can conceive for his comfort.

## AN ADJUSTABLE SPLINT

BY I R SMITH M.B. (TOR.) M.R.C.S. (ENG.) I.R.C.P. (LOND.) TORONTO CANADA

THE following is the description of a splint which I have used on the western front with satisfactory result. It will hold firmly long bones that have been fractured or joints which are to be maintained in a set position for rest.

The splint consists of rods connected by means of an elastic medium such as straps of rubber webbing. This webbing permits the splint as a whole to conform snugly to the various contour of the limb or joint and therefore at the same time exerts the required amount of pressure upon the parts treated. It is simple in construction and may be removed without causing disturbance of the parts and any number of splint rods may

be carried conveniently in a roll. The desired number of connecting rod may be separated from the roll by cutting through the elastic medium thus giving the width and the required length is secured by cutting the rod.

Figure 1 shows the splints spread out flat. The detail of the construction may be readily understood from this drawing.

Figure 2 represents a side view partly in section of one of the splint rods and the elastic connecting strip shown in Figure 1.

Figure 3 is an end view of a series of splint rods such as those shown in Figure 1.

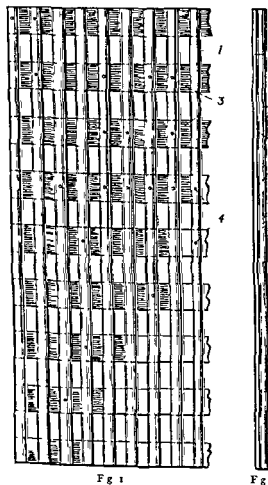


Fig 1

Fig

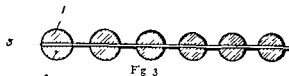


Fig 3

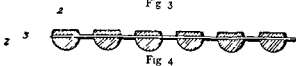


Fig 4

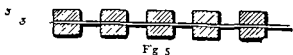


Fig 5



Fig 6

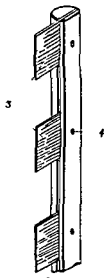


Fig 7

Figures 4 and 5 are similar views showing the individual splint rods of modified configuration.

Figure 6 illustrates on an enlarged scale one of the splint rods similar to the splint rod shown in Figure 2 but made in one piece with the transverse apertures provided for the reception of the elastic medium to connect the rod.

Figure 7 is a perspective view of the modified form shown in Figure 4.

#### DETAILED DESCRIPTION OF CONSTRUCTION

Like reference numerals indicate like parts in all these drawings.

In the drawings 1 represents a longitudinally extending rounded half section of a splint rod which may be made either of cane, wood or other flexible material. 2 represents a similar oppositely located section. 3 represents the elastic medium such as the rubber strap located between sections 1 and 2. The rod forming these sections may be made of any desired length and the elastic medium of any desired width since it may be found convenient to support any number or lengths of splint rod.

In the construction shown 4 represents rivets which can be used for additional strengthening of the elastic medium to the splint rods.

In Figure 1 4 represents pins or rivets passing through the rod section 1 the elastic medium 3 and the opposite rod section 2 whereby the sections are held together in proper position relative to the elastic medium 3.

In the drawings the rod sections 1 and 2 are made of cane rods split through the center, cane being very desirable for its longitudinal elasticity whereby it may readily assume the contour of the part to which it is applied.

In the modification shown in Figure 6 5 represents a series of hoops which are formed by cutting or mortising through the center of the cane rods and the elastic bands in this drawing are passed through these hoops and may be fastened in place by pins or rivets similar to the rivets 4. Or if preferable the parts may be secured in position

by gluing or cementing the elastic bands within these hoops or if desired the individual splint rod may be mounted slidable on the elastic straps so that an increased number of rods may be applied to a given area. In the construction shown in Figures 1 2 3 4 5 and 7 the elastic band or straps will be secured between the cane sections either by gluing or cementing them there or by means of pins or rivets.

#### METHOD OF APPLICATION

In the modified form of splint rod shown in Figures 4 and 7 it will be noted that only one of the rounded sections of the cane rod is used and that an elastic medium is held between its flat face and the face of a flat thin strip of wood. These three elements may be united by applying cement or glue upon the surface engaging the elastic medium or may be united as shown in Figure 7 by pin or rivet.

Figure 5 is an embodiment of a splint with rod which are square. The detail of the splint will be readily understood from the drawing and therefore do not require any more detailed description.

In applying this splint as before stated it may be conveniently made in great widths and a portion of any required width or length sufficient for a particular part to be treated may be separated from the main portion by cutting longitudinally enough for the main portion.

The limb is first prepared and well padded with absorbent cotton and the splint is drawn taut around the limb distending the elastic medium. When the splint is in position an adhesive strap is wound over the splint rod to retain them in their extended fixed position. The longitudinal flexibility of the splint rod would of course respond to the particular outline of the limb. The elasticity of the straps 3 permits the accommodation of the rod to the stouter or enlarged portion of the limb to be treated so that throughout its length it snugly fits the limb just like a plaster-of-Paris cast.

## NOTES ON THE DAVIS AND CUSHING METHOD OF SAVING BLOOD DURING MAJOR INTRACRANIAL OPERATIONS

By J. VERNON HAHN, M.D., INDIANAPOLIS  
 The Lucius S. Taylor Memorial School of Medicine

THE great importance of having a therapeutic measure at hand for the treatment of exsanguination and shock during and after intracranial operations is universally admitted. It is also axiomatic that restoration of blood volume and replenishment of blood corpuscles are the only known means of meeting the indications in many cases. The difficulties of obtaining compatible blood and of effecting its transfer to the patient make the method reported by Davis and Cushing<sup>1</sup> a welcome addition to our armamentarium in all sanguinary operations in which uncontaminated blood may be collected.

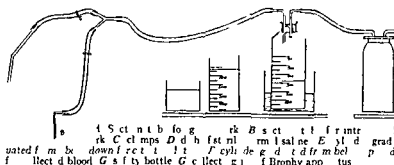
In brief, the Davis and Cushing method consists of aspirating blood from the field of operation through a glass tube connected by a rubber tube with a collecting flask which is continuously evacuated of part of its air by means of a water pump (filter pump). The aspirating tube is frequently dipped into 2 per cent sodium citrate solution to prevent clotting of the collected blood. At any time during the operation or after it, the salvaged citrated blood may be employed as an intravenous infusion. The cases reported by Davis and Cushing in which this method was

In this experience I employed a slightly different arrangement of apparatus and further changes have occurred to me which I wish to embody in this paper as suggestion.

Instead of the water suction pump, the usual Brophy suction apparatus gave good service in my case. The collecting bottle of the Brophy apparatus was employed as a safety bottle standing between the pump and the blood-collecting bottle. Had the motor stopped accidentally, oil or water from the pump which might have been sucked back into the partly evacuated collecting bottle would have been caught by the safety bottle.

Another change was in providing the collecting bottle with a Y tube so that two aspirating tubes might be carried to the operating table. One of these was connected with a suction tube of glass 4 millimeters in diameter for use in the gross work of entering the skull. The other tube was attached to a much more delicate glass tube which was bent at right angles and used to aspirate the depth of the middle fossa. Each rubber tube was provided with a clamp so that the one not in use could be excluded.





suggests that the collecting bottle be cylindrical and graduated and that the citrate solution be kept in a similar vessel. By dividing the volume of the collected fluid into the volume of citrate solution used, the percentage of sodium citrate in the diluted blood can readily be obtained. An extra assistant or a nurse could make this simple calculation at intervals and advise the operator of the exact concentration of citrate in the collected fluid. The concentration of sodium citrate could be kept below some maximum value by employing normal saline solution when it became desirable merely to flush the tubes mechanically. No record need be kept of the volume of normal saline.

In view of accumulated experience in blood transfusion and inasmuch as the fluid is filtered free of small clots before its injection, a concentration of 0.7 per cent of sodium citrate should be adequate. In a 500 cubic centimeter transfusion the dose of citrate would thus be well under the toxic limit.

If the blood collecting bottle is kept in plain view of the surgeon upon a side table rather than under the operating table as described in the Davis and Cushing paper, a quite accurate knowledge of the amount of hæmorrhage is at all times available to the surgeon without his asking any questions.

Both the changes in apparatus which the author employed and those he has the temerity to propose are embodied in the sketch. Following is a very brief report of my case. Full details of the pathological findings will appear in another paper.

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#### CONCLUSIONS

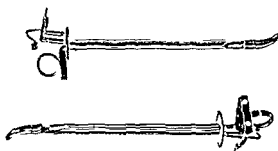
- 1 Suction methods are an improvement over pouncing in intracranial operations.
- 2 Blood may be recovered and citrated for use in relieving operative shock and exsanguination.
- 3 The use of a graduated collecting vessel is suggested as a possible improvement in the method of Davis and Cushing.
- 4 A case of endothelioma of the gasserian ganglion is briefly reported.

A VISUAL PROSTATIC PUNCH<sup>1</sup>

BY D. K. ROSE, M.D., ST. LOUIS, MISSOURI

SINCE the Hugh H. Young prostatic punch (1909) several modifications both of principle and mechanics have been brought forth: the Young cautery punch of 1911, the J. R. Caulk cautery punch of 1920, and the Geraghty sphincterotome of 1922. In no case, however, has an attempt been made to prevent hemorrhage by cauterization with a visual instrument, so that several punches from the prostatic orifice can be made at one sitting and all under direct and so selective vision. These important factors are accomplished with the instrument described.

First, the instrument affords vision by having a large oval single sheath for cutting and cauterizing, which can carry illumination throughout its length. Second, it provides hæmostasis by cauterizing with an electrically heated platinum plate which immediately follows the cutting (steel) knife. The knife, cauterizing plate, and its conduction wire are a part of or incorporated in the narrow sliding portion of the sheath, which is controlled by a thumb ring fastened to an ebony, asbestos, and steel plate placed at right angles to



the shaft. The ease of cutting with a sharp blade renders unnecessary any other than thumb pressure, which is applied at a point well out of line of vision. The first cylinders of prostatic tissue are removed with long forceps or pushed up into the hollow tip with a long wood applicator. A 110 alternating current is used for heating the cautery.

Success in overcoming the mechanical difficulties of the instrument is largely due to R. H. Tontrup, instrument maker, St. Louis.

From the Department of Surgery, Washington University School of Medicine, St. Louis.

# MEMOIRS

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## SIR RICKMAN GODLEE

SIR RICKMAN GODLEE the godfather of the American College of Surgeons an ex president of the Royal College of Surgeons of England author of a famous biography of Lord Lister and a surgeon of international reputation died at Coombe End Farm Whitchurch Oxon England on Sunday night April 19 1925 Until within two hours of his death he was apparently in perfect health and for a man seventy six years of age he was unusually vigorous and active

Doctor and Mrs Franklin H Martin close friend of Sir Rickman and Lady Godlee since their journey to Chicago to represent the Royal College of Surgeons of England at the first Convocation of the American College of Surgeons went to Whitchurch to spend the week end of April 18 at Coombe End Farm Sir Rickman and Lady Godlee met their guests at the station at Poughton on Saturday afternoon Saturday and Sunday two delightful days were given to motoring in the country about Oxford punting on the Thames that flows within sight of Coombe End Farm examining the operations on the farm long walks about the country and in social intercourse in and about the cozy country home

On Sunday afternoon Sir Rickman complained of gastric pain and Dr Leslie the family doctor was called In the course of the examination a pulsating tumor was located slightly to the left of the middle abdomen Sir Rickman remarked that some specialist in going over him within the year had pronounced this as a probable aneurism Dr Leslie however could trace no direct connection between this pulsating tumor and the gastric distress and as the condition of the patient did not seem serious he was given a sedative and the incident passed over as an unimportant temporary indisposition At eleven thirty o'clock Sunday evening Dr Martin was called Sir Rickman was found to be in a dying condition Five minutes before he had cried Something has given way He was in great distress pulseless and there was evidence of profound shock with symptoms of acute internal hæmorrhage He immediately lapsed into unconsciousness and before twelve o'clock he was dead The cause of death was given by Dr Leslie as aortic aneurism There was no autopsy

On Thursday afternoon April 23 the oaken casket which contained the remains of Sir Rickman was borne to the little English church at Whitchurch on the shoulders of eight young men among whom he had lived in the country and by



SIR RICKMAN JOHN GODLEE BART K.C.V.O.  
1849 1925

whom he was loved and respected. A special train from London carried to the funeral Sir Rickman's many lifelong friends, his official associates and representative of his King, all of whom paid silent tribute to a great man and a friend. The services were very simple with the local Rector and choir attending. He was laid to rest in a grave under the cedars in the adjoining churchyard.

Sir Rickman Godlee, in his official capacity as president of the Royal College of Surgeons of England, did a great service to American surgery when he volunteered in behalf of his time honored organization to act as official sponsor and orator at the first Convocation of the American College of Surgeons, November 13, 1913. During his visit there developed on his part a personal friendship for our College, our journal, our Clinical Congress, and for a host of their individual members, and this friendship was reciprocated. In a long walk on the morning of the day of his death he discussed with enthusiasm our American institution and asked after the personal welfare of many individual surgeons whom he had learned to know and admire, and who were his friends in America.

Sir Rickman was as generous as he was great in usefulness and in influence. In his last moments of consciousness, although he was in great agony, his concern was that his death, which he recognized as being near, would be an inconvenience to us, his friend, and that his suffering would give pain to his life's companion whom he loved and who loved him.

The following biographical sketch is an abstract of an obituary notice which appeared in the April 21 issue of *The London Times*:

Sir Rickman Godlee. He came of an old Quaker family, being the second son of Rickman Godlee, a well known barrister of the Middle Temple by Mary, daughter of Joseph Jackson Lister, the father of Lord Lister. He was thus a nephew of the great surgeon whose life he wrote, and a cousin of Marcus Beck, who influenced for good several generations of medical students at University College Hospital, where he was surgeon and a great teacher of surgery. Rickman Godlee was born at Upton, Essex, on February 15, 1849, and was brought up amongst those surroundings of a well-to-do Quaker family, which he afterward described graphically in his life of Lord Lister. He was educated at a school at Tottenham, and took his B.A. degree at the University of London in 1867.

Entering at University College, he soon proved himself a most expert dissector. He was admitted a member of the Royal College of Surgeons in 1872, and was elected to the fellowship in 1876, having, in the interval, taken the degrees of B.S. and M.S. at the London University, after winning the gold medal at each examination. He was house surgeon and house physician at University College Hospital, and then went to Edinburgh to learn the new method, which were being introduced into surgery by his uncle. On his return to London he was appointed surgical registrar at University College Hospital, and was elected assistant surgeon at Charing Cross Hospital and North Eastern Hospital for Children. In 1877 he

was elected assistant surgeon at University College Hospital and was appointed assistant demonstrator of anatomy in the medical school. Soon afterward he became surgeon to Brompton Hospital where he made important advances in surgery of the chest.

At the Epileptic Hospital in Regent's Park Godlee performed one of the earliest operations for the removal of a tumor from the brain the position of the tumor having been previously ascertained by employing the method evolved by Sir David Ferrier in experiments.

At University College Hospital Godlee became surgeon consulting surgeon and eventually eminent professor of clinical surgery. At the Royal College of Surgeons he filled all the usual offices including that of examiner in anatomy and membership on the court of examiners until he was elected president for the years 1911-13 in succession to Sir Henry Butlin who died during his tenure of office. He was surgeon to the household of Queen Victoria and was surgeon in ordinary to King Edward VII and to King George V. He was created a baronet in 1912 and was gazetted K.C.V.O. in 1914. He married in 1891 Juliet Mary daughter of Frederic Seebohm LL.D. D.Lit. of The Hermitage Hitchin but had no children. After his retirement from London in 1920 he went to live at Coombe End Farm, Whitchurch, Oxon. where he died.

# EDITORIALS

## SURGERY, GYNECOLOGY AND OBSTETRICS

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JULY 1925

### UROGRAPHY

THE term urography is used to indicate the roentgen ray examination of the various divisions of the urinary tract which have been rendered opaque by the various mediums. The present widespread employment of urography as an aid in the diagnosis of surgical conditions involving the urinary tract merits careful consideration of its use as well as its limitations. Although the method was first successfully brought out by Voelker and von Lichtenberg in 1906, it is only within the last eight or ten years that its clinical value has been recognized and that its use has become general. Probably the greatest factors in bringing this about were the employment of comparatively harmless mediums, standardization of technique, and wider familiarity through pyelographic interpretation. With the employment of the halogens as a pyelographic medium, much of the danger attending pyelography was eliminated. In 1918 an aqueous solution of sodium or potassium iodide was suggested by Cameron; subsequently a solution of potassium iodide by Rubritius and of sodium bromide by Weld. These solutions were at first employed in a concentration of

25 per cent, but it was later found that a 12 per cent solution of sodium iodide and a 13 per cent solution of sodium bromide give a satisfactory outline and cause less local irritation than the more concentrated solutions. As to the choice of a medium, the fact that sodium iodide solution is isotonic to the tissues in lesser concentration than sodium bromide and is consequently less irritating when retained in the renal pelvis probably makes the former preferable.

As a medium for cystography, the halogens are not quite as satisfactory, since they cause considerable local irritation when the mucosa of the bladder is inflamed. Suspensions of iodide in an oil base and silver iodine emulsion 5 per cent have proved to be satisfactory and are doubly useful in the bladder in that they are therapeutic as well as diagnostic. Air inflation has also been employed for this purpose but is not always satisfactory since it causes pain when the bladder is overdistended and occasionally extensive emphysema of the tissues.

Probably the most essential technical precaution is against overdistending the renal pelvis. It really does not make much difference whether the medium is injected by a hand syringe or by gravity if ordinary care is used and the injection is stopped as soon as the patient complains of discomfort. It is obvious that the medium employed should be sterile; the sterilization can be accomplished by dissolving 1 gram of mercuric iodide in 3,000 cubic centimeters of 1 per cent sodium iodide. A comparatively small ureteral catheter is preferable because it permits return flow into the ureter in case of pelvic over

distention. The catheter should be left in place for a few minutes after injection to permit the medium to drain from the pelvis.

It should be emphasized that in spite of an ideal medium and every technical precaution urography should not be a routine procedure. There are definite contra-indications to its use such as (1) the age or great emaciation of the patient (2) advanced bilateral renal disease and (3) the apparent lack of benefit from surgical treatment. The general rule that no instrumentation should be employed in the urinary tract which is not necessary to complete a diagnosis should be strictly observed. Doubtless urography is being frequently employed unnecessarily. It should not be employed merely to corroborate a diagnosis which can be readily made without its use such as evident hydronephrosis, renal stone or renal tumor.

It should be recognized moreover that urography is not without some danger to the patient. When the injected medium is retained in the renal pelvis it may be absorbed into the renal tissue and might occasionally cause acute renal infection. Retention of pyelographic mediums may occur with pyelectasis from any cause and particularly with occluding ureteral stone, polycystic kidney and renal neoplasm. When there is any clinical or cystoscopic evidence suggestive of these lesions it is advisable to leave the ureteral catheter in position for an hour or more to insure thorough drainage of the pelvis and then to institute lavage with sterile water. If in spite of this precaution clinical evidence of acute renal infection should develop surgical intervention should not be delayed. Fortunately with the employment of the various technical precautions such complications will seldom occur. However the possibility precludes the routine use of bilateral pyelography.

The suggestion of rendering the urinary tract opaque by means of sodium iodide injected intravenously which was made recently by Rowntree and associates is still in the experimental stage. While the principle involved is one of fundamental importance and may offer much for the future nevertheless with the present methods the renal pelvic outline is not sufficiently clear to be of much value in interpretation. The outline of the bladder has frequently proved to be more accurate and the method may be applicable in those cases in which the passage of a catheter in order to make a cystogram would be inadvisable. For this purpose the oral administration of iodides in moderate dosage may be sufficient.

Because of the difficulties involved in the application of urography it should be used only by physicians who are thoroughly familiar with the technique. However its clinical value is such that it will undoubtedly be increasingly employed.

WILLIAM F. BRAASCH

#### THE FORAMEN OF WINSLOW

THE foramen of Winslow is formed by the rotation of the primitive stomach and connects the retrogastric space or lesser peritoneal sac with the greater peritoneal cavity. It is normally about 8 centimeters in circumference enough to admit two fingers. It is particularly useful to the surgeon in palpating the common duct and other structures in the immediate vicinity. If one could speak of its having any function it would be only as an outlet for peritoneal fluid formed in the lesser sac. The condition of hydrops saccatus—a collection of free fluid in the lesser peritoneal sac—appears to be very rare probably because the foramen of Winslow is usually open and also because the absorbing power of the upper peritoneum is greater than that of the lower.



The statement is made in many textbooks that the foramen of Winslow is often closed and it seemed worth while to investigate the accuracy of it. For the past 5 years we have noted the condition of the foramen in nearly all of our laparotomies where an exploration of the upper abdomen was justified. During that time we have found the Winslow closed in 18 cases in approximately 700 laparotomies—about 2½ per cent. It is interesting to note that in 17 of those cases where the foramen was closed the gall bladder was diseased—in the remaining 1 case there was a carcinoma of the cæcum with intussusception. We have gone over the records of the last 109 cases in which laparotomy was performed for upper abdominal conditions. The foramen was found

closed in 13 cases approximately 12 per cent while it was patent in 96 cases. However of these 96 cases more or less dense adhesions in and about the foramen were noted in 43 cases. In view of the fact that the anterior and posterior margins of the foramen are normally quite close to each other it seems surprising that it is not more often sealed by adhesive inflammation. The infrequency of hernia through the foramen of Winslow is readily explainable by the anatomical disposition of the small intestines and the usual fixation of the hepatic flexure of the colon.

Our conclusion based on the material we have studied is that the foramen is seldom closed except as the result of gall bladder disease.

WALLACE I. TERRY





FRANK HARTLEY  
1856-1913

# MASTER SURGEONS OF AMERICA

## FRANK HARTLEY

**F**RANK HARTLEY surgeon was born in Washington D C June 10 1856 son of John Fairfield and Mary D (King) Hartley His father was a lawyer and for many years assistant secretary of the United States Treasury his grandfather was Samuel Hartley who during the war of 1812 held a letter of marque from the United States government and a commission as lieutenant in the Navy

Dr Hartley attended the Emerson Institute in Washington and was graduated at Princeton College in 1877 He studied medicine at the College of Physicians and Surgeons New York City receiving his medical degree in 1880 For two years he was interne at Bellevue Hospital and then took special courses at Heidelberg Vienna and Berlin universities

Returning to New York in 1884 he was appointed assistant demonstrator of anatomy at the College of Physicians and Surgeon and four years later became demonstrator In the meantime in 1886 he became visiting surgeon to Bellevue Hospital and assistant visiting surgeon to Roosevelt Hospital holding the former position for four years and the latter for thirteen In 1890 he was appointed attending surgeon to the New York Hospital and in 1893 consulting surgeon to the New York Skin and Cancer Hospital He was also instructor in operative surgery on the cadaver at the College of Physicians and Surgeons from 1888 to 1900 and then became clinical professor of surgery In the same year he became consulting surgeon to the French Hospital New York Nyack Hospital Nyack New York and St Joseph's Hospital Paterson New Jersey

He was associated with Dr Henry B Sands in private practice and was his assistant at the Roosevelt Hospital up to the time of Dr Sands' death in 1888

He was famed among his confreres for his unusual proficiency in anatomy and his bold and skillful operative technique Even in the earlier years of his career as an operating surgeon many difficult and hazardous surgical cases were referred to him as the one man who never shirked the responsibility involved and who had the ability and courage to cope successfully with surgical problems from which the average operator would shrink Thus became more and more noticeable in his later year for he held his place as the outstanding surgeon to whom physicians looked for help in their bad risk cases Whether brilliant result or failure followed his effort he was always ready to give the best that was in

him for the good of the patient and his indomitable courage and fighting spirit combined with his consummate surgical skill carried many a desperate case through to a successful conclusion

Though his operative activities were broad and general he was especially interested in the surgery of the brain and nervous system and attained great distinction in this field

His most memorable contribution to medical literature was on the subject of trigeminal neuralgia Intracranial resection of the gasserian ganglion was first suggested and performed by him for this disease and the operation but little modified is now widely adopted As Dr Krause of Altona Germany independently performed the operation at about the same time it is generally known as the Hartley Krause method

Dr Hartley wrote many monographs on surgical subjects Among his papers are Congenital Deformities of the Neck Early Operation in Appendicitis Thyroidectomy The Operative Treatment of Club foot and Abdominal Echinococcus and Laminectomy

He was a member of the New York Pathological New York Surgical New York Clinical the New York Medical and Surgical the American Medical the American Gastro-Enterological and American Urological Societies as well as the University New York Athletic and Princeton clubs and the Southern Society He was an enthusiastic lover of all forms of athletic sport He was married August 1 1897 to Emma Allyce Parker daughter of George Burton and Mary (Granville) of Norfolk England who survived him Princeton conferred upon him the degree of Doctor of Laws in 1909 He died in New York City June 19 1913

CHARLES H. PECK.

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD FEBRUARY 6 1925 DR CARL CULBERTSON PRESIDING

### ADENOCARCINOMA OCCURRING IN A PEDUNCULATED GROWTH

DR HENRY SCHMITZ On September 2 1924 an O para aged 40 years school teacher was admitted to the Mercy Clinic. The only symptom she presented was a very profuse leucorrhoea of 8 years duration which was at times blood stained. On examination it was found that she had a large cauliflower growth which almost filled the entire vagina. The tissue was very friable. There was no infiltration of the left parametrium but in the right parametrium was a very large mass the size of a man's fist which was firmly fixed and of hard consistency. On account of the size of the growth and the mass in the right parametrium it was decided to treat the patient for an inoperable carcinoma with intra-cervical application of radium and short wave X-rays. On October 17 the cauliflower growth had reduced about one half in size but the other condition in the pelvis was the same.

When she returned for a third examination on December 1 it was found that this cauliflower growth had been reduced to one third of its former size and that it was very fibrous but otherwise the condition in the pelvis had remained exactly as it was on the first examination. Histological examination of the tissues removed on each of the three previous examinations showed it to be an adenocarcinoma. In view of the fact that the cauliflower growth had not disappeared it was decided to perform an exploratory operation to see if it were possible to remove the uterus. On opening the abdomen we found a large mass within the right broad ligament which proved to be a lipoma and was removed. An extended panhysterectomy was then performed. The cauliflower growth had a pedicle which was attached to the cervical wall. There was absolutely no invasion of the rest of the uterus.

The case is reported for the following reasons: (1) the large lipoma was within the broad ligament; (2) the adenocarcinoma occurred in a pedunculated growth and the pedicle was attached to the cervical mucosa without any extension into the cervical wall; (3) there was only partial retrogression in the size of the growth after the radiation treatments; (4) primary healing of the exploratory incision was not retarded in spite of the massive doses of roentgen rays and radium which had been administered on previous occasions.

### HETEROTOPIC NIPPLE

DR LILL RIFE A white woman 40 years old was to be operated on for multiple fibroids. At examination a nipple-like structure was found 2 centimeters above the right anterosuperior spine of the ilium. The nipple was 3 millimeters in diameter and 1 millimeter high. A ring-shaped area 3 millimeters in diameter around it and the nipple were a little more pigmented than the surrounding skin. This nipple was removed. The microscopic examination showed epidermis with papillae and brown pigment in the basal layer. From the middle of the nipple a slightly tortuous duct extended downward into the cutis but ended blind without any coil formation. The duct had two layers of epithelium the inner cuboidal the outer rather flat and somewhat irregular. The lumen was distinct at the point at which the duct passed through the epidermis there was a straight canal not a pore.

The duct looked very much like the duct of a sweat gland but as the ducts of the sweat gland are known to pass through the epidermis in a spiral the duct was deemed to be a milk duct and the structure was diagnosed a rudimentary accessory nipple. The patient stated that after the births of her children this structure did not enlarge nor secrete.

### HEMATOMA OF THE RIGHT OVARY WITH SEVERE HÆMORRHAGE IN THE PERITONEAL CAVITY

DR DAVID C. STRAUSS The patient L. M. 19 year of age single was first seen by me at 12:30 a.m. January 13 1925. She complained of pain in the right lower quadrant of the abdomen very severe localized and accompanied by nausea but no vomiting. She did not look very ill and her color was good. Three days before January 10 she began to have slight pain in the right lower quadrant of the abdomen while at work. The pain increased in severity for three days but she continued her work. The pain remained localized however and she felt nauseated but did not vomit. The third night she went to the theater where the pain became so severe that she could hardly keep her seat. She came home and called her family physician who in turn called me.

When I arrived she was lying quietly in bed but complained of severe pain though she said it was not as severe as it had been a short time before. Her

pulse was 80 and of good quality. Temperature by mouth was 98.6 degrees. Except for a suggestion of more resistance on the right side low down than over the left there were no abnormal physical findings. She did not remember the exact date of her last menstruation but said it was about a month before. Her breasts were normal not enlarged.

The history indicated acute appendicitis. The white blood count was 19,500, the differential count showed 76 per cent polymorphonuclears. Rectal examination showed no striking findings. There was some tenderness high up on both sides perhaps a trifle more on the right than on the left—no bulging was made out. There was no vaginal discharge and no Chadwick sign.

When the patient arrived at the hospital a rectus rigidity was more pronounced and the temperature per rectum was 100 and pulse 80. The local findings seemed clearly to exclude the possibility of a ruptured ectopic pregnancy or acute salpingitis. It is to call attention again to ruptured ovarian cyst in the differential diagnosis of acute appendicitis in women that I am reporting this case.

Immediate operation was arranged for. The abdomen was opened by means of a low McBurney muscle splitting incision. On opening the peritoneum a gush of bright red blood poured from the wound. The interne thought I had cut a large artery but as I had seen the same picture in a case some years ago I at once stated that it was an ovarian hemorrhage with rupture into the peritoneal cavity. I at once enlarged the incision by continuing the skin incision in its original direction and by dividing the deeper layers parallel to and along the outer border of the rectus. This gives a very satisfactory exposure of the right iliac fossa. The right ovary was quickly found. It presented a swelling about the size of a plum. On grasping it gently a large blood clot came from within it and the mass collapsed. The very large amount of free bright red blood in the right iliac fossa and pelvis was sponged away and flowed out through the wound a total of probably one quart in all. There was a large bleeding surface which extended for practically the entire length of the ovary which was elongated and shaped more like a finger than an ovary. The distal half of the ovary was discolored from intrasutural hemorrhage and several small follicles were seen filled with blood. The bleeding came from a large ruptured follicle located at the surface and occupying the entire distal one half of the ovary. This portion of the ovary was resected. Next the left hand was introduced into the Douglas and numerous massive blood clots were lifted out. The uterus was palpated and was normal. The right tube was normal as were also the left tube and ovary. The appendix was not seen. The remaining liquid blood was carefully sponged away with gauze sponges all bleeding controlled and the abdomen closed in layers without drainage. The patient left the table in good condition. On return to bed her pulse was 80 and of good quality. She made an uneventful recovery and was discharged

on January 22, 1925. She began to menstruate two days after the operation.

The pathological report showed the specimens to be follicular cysts of the ovary. No endometrial tissue was present in the ovary. Up to June 1914 only 50 cases had been reported in the literature. At this time Hinchey reported 2 additional cases and gave an excellent review of the subject. Of the 50 reported cases with intraperitoneal hemorrhage the bleeding was from follicular cysts in 20, from corpus luteum cysts in 22 and from hæmangiomas (type not stated) in 17. He pointed out that the preoperative diagnosis is made in most cases abstracted from the literature was ectopic pregnancy or acute appendicitis. In most instances the true diagnosis was not established until after the peritoneal cavity had been opened. Obviously although the condition is infrequent it should be considered in the differential diagnosis of acute abdominal conditions.

#### OVARIAN FOLLICULAR CYST SIMULATING ECTOPIC PREGNANCY

DR. CAREY CULBERTSON. Mrs. L. F. aged 32 was of a slender well nourished type. She had 2 children 4 and 2 years of age respectively. Menstruation began at 15 was of the regular 28 day type 4 days in duration. The last period was August 22, 1923 occurring at the regular time. On August 26 she began bleeding again but this was intermittent and scanty and not like a regular period. For 4 months she had had severe lumbar backache which was worse in the morning and on arising from a sitting posture. For the past few days there had been some tenderness and soreness in the lower abdomen on both sides.

Examination on August 31 showed the abdomen scaphoid thin walled with superficial tenderness over both lower quadrants but no masses were palpable. On vaginal examination the cervix was soft and pointed toward the back. The corpus of the uterus was upright slightly enlarged and free. There was a lemon size mass which was tender on the right side between the uterus and the pelvic wall. The left side was normal. She fainted after the examination and was taken directly to hospital.

She was operated on the following morning. The uterus was upright but relaxed small and firm. The left tube and ovary were normal except for 3 small cysts on the umbrae of the tube. The right tube was patent. Stretched about the circumference of the right ovary was a cyst 6 centimeters in diameter with evidence of recent hemorrhage. It was reddish blue in color. The appendix and gall bladder were normal. There was no ptosis of the colon. A right salpingo-oophorectomy was performed shortening of the round ligaments for peritonization.

I report this case because of the very slight extent of the pathological lesions found and because of the close resemblance to the findings in ectopic pregnancy in spite of the fact that there was no preceding amenorrhoea. The cystic portion of the ovary proved

to be a recent hemorrhage into a follicle. It was not a corpus luteum cyst. Microscopic sections showed no tissue endometrial in type and no evidences of pregnancy.

#### GUNSHOT WOUND THROUGH THE PELVIS CHARACTERIZED BY AN UNUSUAL ANATOMICAL COURSE

DR. CARL ALFONSO BACON. I wish to report briefly a case of gunshot wound through the pelvis which is characterized by a rather unusual anatomical course and invite your discussion on its management.

The patient, a woman of 25, was shot at close range with a special soft nosed bullet of 0.32 calibre. The shot entered just above and about 2 centimeters to the left of the symphysis pubis. It followed between the symphysis and the bladder and severed the urethra in about its middle portion, tearing it out completely in that region as it entered the vagina. It left the vagina on the right side about 1 centimeter inside the vulva, missed the rectum and emerged inside the middle of the right gluteus maximus muscle without damage to any nerves or arteries of importance. Another shot which entered the head in front of the left ear and curved down to the back of the neck, caused a large amount of hemorrhage so that she was in a state of considerable shock when first seen. Twenty-four hours after the injury, without at that time knowing the exact extent of the injury, as the patient had not passed any urine, we attempted to catheterize in the ordinary manner without success. The second day 40 hours after the accident we prepared the patient exactly as for a vaginal operation for the purpose of passing a catheter into the bladder through the posterior portion of the urethra from the site of the injury under a good view if possible. On account of the trauma we were again unable to do this. In fact we were unable to determine the condition of the posterior urethra because of oedema of the labia and a large hematoma in the right vulva.

Finally we made a direct opening into the bladder from the vagina, forming a fistula into which we inserted a retention or Pezzet catheter. A large amount of urine was found in the bladder.

We partly justify the intentional formation of a fistula by the need for drainage. Later when a plastic repair of the urethra is to be done, with a finger in this fistula we were not able readily to palpate the urethral orifice with a view to passing a catheter through it from within.

I would like to know whether we should have waited longer for a possible spontaneous emptying of the bladder. Would it have been preferable to make a suprapubic cystostomy? How can we best restore the urethra?

#### DISCUSSION

DR. N. S. HEANEY. Why was the Pezzet catheter put in? Those fistulae will stay open without the

insertion of a catheter which only adds to the discomfort of the patient. When we make an artificial fistula to clear up a tuberculous bladder or an intractable cystitis, we usually make an incision and sew it back and forth and leave it open. The fact that the bladder had to be drained showed that the urethra was still functioning. If plenty of time were allowed the urethra might heal and the lower end could be found when the oedema had disappeared.

DR. HENRY SCHMITZ. Was there much tissue missing? In a case I was obliged to make a repair on account of involuntary urinations. The inflammatory reaction had subsided so that I could find the posterior portion of the urethra. I put in an ordinary catheter and then brought the upper portion of the urethra down to the distal part. I used only one stitch. It is a well known fact that the urethra tends to heal very rapidly. Rapid healing followed in this case and the catheter was removed after 7 days.

DR. BACON (closing the discussion). I think the whole middle portion of the urethra was missing. I tried to follow the urethra with a small probe but the mucosa was retracted and there was considerable swelling. I made the fistula about a centimeter back from the traumatized area. I wonder if it would not be best to try to see the internal orifice with a cystoscope in the fistula.

#### ECTOPIC CARCINOMA OF BREAST

DR. EMIL RIFS, CASE 1. A woman 31 years old in 1921 had had 2 children, the last in 1918. She had had a breast infection after the first labor which caused her to wean the child at the age of 4 months. After the second labor she nursed 10 months without difficulty. She had an enlarged gland in the left axilla which were discrete and painful. Outside the left breast along the border of the pectoral major a little above the breast proper there was a firm roundish tumor the size of a 50 cent piece, not adherent to the skin and freely movable. It was thought to be a fibroma of an accessory breast and was removed under local anesthesia. The microscopic examination showed the tumor to be a scirrhous. Radical operation was done a year afterward the patient was found free from recurrence.

CASE 2. A woman 33 years old observed in 1922 had been operated upon by a Chicago surgeon in 1911. At that time she was cured. A week later she had hysterectomy for fibroids and appendectomy and a radical operation for right inguinal hernia. In 1919 on some exertion the hernia recurred. She had never been pregnant. She complained of a tumor below the left breast and pain in the abdomen. Examination showed a recurrent right inguinal hernia from median abdominal scar, a left ovarian tumor the size of a grapefruit and a small uterine tumor. Below the left breast and apparently without connection with the breast a tumor was felt which was firm and sensitive to touch. It rolled under the finger and was cylindrical in shape. It was about 8 centimeters long and 3 centimeters in diameter. It



was thought to be a fibroma. At the operation the left ovarian tumor was removed by an incision through the old median scar. The recurrent hernia was operated upon after Ankrum's method. The breast tumor was excised and examined microscopically. It was found to be a sarcoma. Radical operation was performed at once. The patient made a good recovery and was reported well 3 years after the operation.

In both of these cases the tumor originated ectopically in connection with the breast. In the first case, in connection with the breast proper and the microscopic examination showed no carcinoma in the breast itself.

### DISCUSSION

DR. C. D. HATCH: Was there any special difficulty in making a repair in the first case? Did you have any difficulty in getting the skin approximated? Was there any sloughing afterward? I have a case now that is coming from an operation for such a tumor. I had considerable difficulty in getting the skin approximated in the axilla.

DR. KIES (closing the discussion): In these 2 cases we had no difficulty in approximating the skin such as we often have in extensive carcinomas. Many times in difficult cases we split the other breast in two and use the flaps to close the wound, putting the nipple in the center of the chest. In other cases we have a large wound open to prevent too much tension and use skin grafting.

### A CYST OF THE PERITONEAL CAVITY

DR. PAUL KIES: The patient with this cyst was 33 years old when she came under treatment in 1923. She had had four labors. The first took place 10 years spontaneously. Ten days after it the physician found a tumor in the vagina. But in the fall of the following year the tumor disappeared and the patient went home. In 1923 in the fifth month of her second pregnancy a second physician discovered a cyst in the vagina. The cyst was drained and partially removed. The wound healed in 4 weeks and the patient was confined at term with uterine difficulty. In 1924 and in 1929 the patient was once again at term without abnormality. In April 1923 the patient had a feeling of pressure in the rectum. A third physician who examined her found only retroversion and small cysts of the cervix. Soon afterward the patient had pain in both thighs and later fever. The physician found an abscess forming to the left of the rectum which was opened and curetted in May 1923. In October 1923 this treatment was repeated but the abscess never closed and continued to increase in size.

November 27, 1923, the patient was found to have a small opening to the left of the anus into which a probe could be introduced to a depth of 15 centimeters. The probe moved around in a large cavity which communicated neither with the vagina nor the rectum. The uterus was retroverted freely movable and the adnexa were free.

The patient was operated upon November 3, 1923. An incision was made around the fistulous opening and carried across to the outside almost to the tubular incision. The fistulous tract which started at the opening near the anus was dissected out as in the exterior view of a fistula in situ. Higher up a large cavity lined with a mucosa and containing pus was exposed and dissected out. On the outside of the sac there were numerous (about 20) small cysts filled with clear fluid. The new fistula of the size of a lima bean and a smaller one were removed with the large sac. The lower portion of the sac was placed into the ischioanal fossa but had not yet opened into the rectum or vagina. Sutures and ligatures stopped the hemorrhage which was not serious at any time. Deep sutures through the skin and fat closed the wound almost entirely. A small gauze pack was left in the wound. The patient made a good recovery and had no return of her trouble.

The specimen showed in its upper part a round sac without any fistulous continuity. The lower part appeared much like any fistulous tract. It was lined with granulation tissue in a fibrous wall. The sac was large enough to contain a woman's fist. Its interior was lined with a stratified epithelium which covered a loose connective tissue which formed no papillae. The epithelium was like that of the vagina. It contained no stratum granulosum and no stratum lucidum. The cells of the most superficial layer contained fine granules and the uppermost layers of cells were lightly loosened and easily detached.

The transparent cysts of the outside of this vagina-like sac had an entirely different microscopic appearance. Their epithelium was of 4 types, depending on the greater part of the circumference of the cyst was a single layer of columnar or cuboidal cells here and there with cilia. A second type was found on connective tissue papillae protruding into the lumen of the cysts and consisted partly of a single layer of high cylindrical cells and partly of multiple layers of cylindrical cells. Both here and there according to the section of the section, appeared in many (4 to 6) layers. The sac was imbedded in loose connective tissue with uterine muscular coat.

It is difficult to explain the origin of this tumor. It is so close to embryonic development. While the main part of the sac resembled very much a gastrulation, the transparent cysts attached to the outside were evidently of an entirely different nature. Since the entire structure was found outside the anterior abdominal wall to assume any connection with the ureter or any part of the Wolffian duct.

We have been able to find any similar observation in the literature.

### A NORMAL OBSTETRICAL CASE IN WHICH THE INFANT'S BLOOD SHOWED A DISTINCT TYPING

DR. SIDNEY SCHUCHET: I wish to report a normal obstetrical case in which a woman gave birth to a normal

female child. Two hours after delivery there was a severe hemorrhage from the cord and mucous membranes. We tried the usual methods of controlling this hemorrhage of the new born and we finally decided upon the question of blood transfusion. The mother was type I and found to be Type III. The father was Type IV. We had taken some blood from the child just as a matter of routine and found it was Type II. As you all know as a rule there is no definite type in children until the end of the first year or during the first year. I report this case because of the fact that it is one of the theories of the cause of eclampsia that when a child *in utero* shows a definite typing the mother presents symptoms of eclampsia. In this case there was a definite typing but no symptoms of eclampsia.

#### OCCLUSION OF THE VAGINA—ONE CASE WITH EPIDERMAL CYST

**DR. EMIL RIES. CASE 1.** A married white woman came in 1925 with the following history. In 1902 at the age of 9 months she had what was called black diphtheria in the throat and was very sick with it. She does not know whether the vagina was affected at the same time. She also had had measles and whooping cough during infancy.

In 1914 at the age of 13 she had for a period of 6 months at about monthly intervals intense pain in the abdomen, deep in the pelvis and in the back accompanied by nausea and vomiting. The pain and vomiting became more intense as time went on, lasting from 5 to 14 days. She was taken to a hospital for operation, but on the morning of the day set for the operation she passed a large quantity of black tarry blood. No operation was performed. The flow at that time lasted 2 weeks and returned afterward regularly at 28 day intervals, lasting 3 to 5 days and was of moderate amount accompanied by slight pain.

In 1925 she married. Soon afterward she noticed a constant grayish vaginal discharge. It was found on examination that the external organs were normal. The hymen was broken. The vagina for 3 centimeters above the hymen was normal but an obstruction was met which closed the vagina apparently completely. A small dimple was felt a little to the left of the mid line which on speculum examination showed a grayish discharge from higher up.

The obstruction was cut transversely and the vagina was found perfectly normal above with a well formed cervix. Uterus and appendages were normal. After excising the obstruction the upper and lower edges of the vagina were sutured together. The patient made a good recovery and on examination some 3 months later showed a well healed vagina with a slight cicatricial ring at the site of the former obstruction.

**CASE 2.** A colored woman 21 years old came to the Dispensary in 1924. She had had malaria and measles. At the age of 15 she began to menstruate and the menstruation returned regularly, lasted 3 days rather copiously with a little pain. At the age

of 19 she had her first labor at term. A physician attempted some interference through the vagina but could not finish the delivery. The patient was then taken to a hospital where labor terminated spontaneously. After the labor some sutures had to be made. There was a bloody discharge for 3 days then a yellow discharge for 1 month for which she used vaginal injections. She knows nothing of any septic condition. Since that time she had had no menstruation but pain in the abdomen and back every month. Cohabitation was painful and she stated that the membrum did not enter as far as before the confinement.

December 8, 1924. Complete occlusion of the vagina was found about 3 centimeters above the introitus. Per rectum the uterus was found large, the right appendages thick and the uterus was freely movable. The following day she entered the hospital and noticed for the first time then that she was flowing. The blood was very dark and she stated that after the dispensary examination she had had severe abdominal pain.

December 10, 1924. It was found that the occluding membrane was located about 3 centimeters above the introitus which was normal with the exception of a small perineal tear. The occluding membrane presented cicatricial white stripes. A little to the left of the median line there was a small opening from which blood was escaping. A uterine sound could be introduced through this opening. It was enlarged by means of an artery forceps so that a finger could enter the upper part of the vagina. A normal cervix could be felt and a hard uterine body above it.

December 11, 1924. At operation an olive sized tumor could be felt in the occluding membrane to the right of the small gap. The membrane was excised and the olive shaped tumor as enucleated with slight hemorrhage. Above the obstruction more cicatrices were found in the vagina which bound the cervix to the vaginal wall. Suture of the upper and lower parts of the vagina formed a vagina which easily admitted 2 fingers. Recovery was uneventful.

The tumor included in the obstructing membrane was a cyst the size and shape of an olive. It contained a small amount of yellowish thick fluid. Sections through the wall showed on the outside connective tissue and no muscular coat. The lining of the cyst consisted of stratified epithelium similar to vaginal epithelium but without any papillae. The intercellular bridges between the rete cells were very distinct. There was no stratum granulosum and no stratum lucidum. The superficial layers were slightly flattened but contained well stained nuclei. No glands or inflammatory changes were present.

The history of both cases is quite characteristic of an acquired occlusion of the vagina. In the first case the early severe diphtheria attack though not positively known to have involved the vagina is most likely to have caused ulceration and subsequent cicatricial fusion of the walls of the vagina.

In the second case special interest attaches to the cyst. The fact that it presented no muscular struc-

tures in its wall and I had no papillæ speaks against its being a rudimentary double vagina. It must be classified with those numerous cysts of similar structure which are found near the introitus after obstetrical lacerations and are dependent upon the growth of small islands of vaginal epithelium detached by the obstetrical injuries and displaced into the connective tissue outside the vagina. I have examined a number of these cysts and the structure is quite uniformly that described though the size is usually smaller.

#### DISCUSSION

DR N. S. HEANEY: There was a point in each of the cases on which I was not clear. In one case he said the vagina was about 3 centimeters above the hymen. Was the epithelium from there up to the cervix obliterated? Was there a considerable passage up there? Was the occlusion a transverse membrane above the hymen?

I have had one case of obliteration of the vagina which came on after the woman was married and followed an attack of influenza in which she was seriously ill. The attending physician said they used a membranous coat of the vagina. The healing and occlusion of the upper two-thirds of the vagina. All the epithelium in the upper two-thirds of the vagina was destroyed except that covering the cervix. The upper two-thirds of the vagina was dilated and the cervix was pulled down and stitched to the lower third of the vagina. If the doctor reports that the vagina appears to be quite normal.

DR RIES (closing the discussion): It all depends on how much ulceration has taken place. If there is extensive ulceration extending to the hymen, it may follow. In both of these cases the history seems very clear as to the origin of the obstructed vagina.

#### THAT LAIN IN THE VAGINA

DR EMIL RIES presented a paper on "That Laid in the Vagina which will appear with the discharge of the next menstruation."

PHILANDER ABBEY HARRIS

FRANZ BUMM

FRIEDRICH TRENDLENBURG

CHARLES S. HAYES: I have been a keen supporter of the Society to say a word about the program at gynecology is who have discussed.

Let me first recall to your memory Philander Abbey Harris (later on New Jersey) who formerly attended quite regularly the Section on Diseases of Women of the American Medical Association. He obtained his medical education at the University of Michigan and Columbia University. He was also a Fellow of the American Gynecological Society. At the Society meetings he participated in the discussions as an earnest, thoughtful student and made the impression of a physician in whom all could repose confidence. A valuable contribution was his

method of digital dilatation of the cervix. He died December 13, 1924, at the age of 72 years after a long illness.

The gynecologists of America as well as those of Germany and in fact of all the world will unite in mourning the death of Franz Bumm who died in Munich on January 3, after an illness of 3 days from peritonitis following rupture of the gall bladder. He was generally acknowledged as the greatest German gynecologist and at the time of his death, although 66 years old, he was at the height of his power.

Bumm was born at Würzburg in 1858. After his graduation in medicine he was for 3 years assistant of Schanz and became Dozent at the early age of 27 years. In 1884 he became professor in Basel and in 1900 he came to Halle as the successor of Hehl. In 1904 he came to Berlin in the Frauen Klinik of the Charité as the successor of Cramer and in 1910 on the retirement of Ollenhuis he succeeded him in the Universitäts Frauenklinik.

I saw him but once in the Charité but his personality made an impression not to be forgotten. He was a wonderful lecturer and his skill in diagnosis and treatment to his power. I saw him do a radical carcinoma operation. It was a rapid and skilful operation but did not excel in precision.

Bumm was probably best known in America by his textbook on "Tetrads" one of the best textbooks ever written and illustrated as no book had been before its appearance. At the time of his death he was preparing another book that would have rivaled his "Tetrads"—on gynecological operations. One part of the great work was to be in the hands of the printers and it will be looked for with much interest.

Bumm's first work was in the study of gonorrhea and he was the first or one of the first to culture the gonococcus. His interest in bacteriology continued to the last and he made many contributions to the subject of puerperal sepsis and other infections.

Among the other subjects to which Bumm gave especial attention we should mention carcinoma of the uterus. After a large experience in the radical abdominal peritonectomy he made a thorough trial of radium and roentgen therapy which however he finally abandoned.

As a teacher, a writer, as a research worker, as a man interested in the social problems of mankind, and as a great and impressive personality, we can honor Bumm who has well represented our specialty and its history to our profession.

We cannot omit a word of appreciation of the great surgeon Friedrich Trendelenburg, who died in Berlin December 16, at the age of 80 years. He was professor of surgery in Kassel and Bonn and went to Leipzig in 1875. Among the numerous contributions to surgical problems we are especially interested in his discovery of the value of the elevated pelvis in abdominal operations. The importance of this method in pelvic surgery can scarcely be overestimated. We are glad to add our tribute to the memory of this great man who lived to enjoy the prominence and honor due a useful life.



A  
**DISCOURSE**  
OF THE VVHOLE ART  
OR  
**CHYRURGERY**

VVherin is exactly set down the Definitions  
Causes Accidents Prognostications and Cures of  
all that is to be done in Chyrurgery  
with his own method of teaching  
by Chyrurgion Accorded to the practice  
of the best of Physicians of this time

Which is not only profitable for Chyrurgions but  
also for all the people both for prevention  
of sickness and cure of it

Complished by P. L. S. Thomas Doctor in the  
Faculty of Chyrurgery Paris and Chyrurg  
in the University of Paris

Whereunto is added the Rule of making Remedyes  
Chyrurgicall and Anatomical of the  
of Dr. Hippocrates

Translated by J. C. and J. H. and J.

LONDON Printed by R. Halstons

THE  
**PRESAGES**

OF

Divine Hippocrates

Divided into three parts VVith the  
Protestation or Oath which Hippocrates  
caused his Schollers to make at their  
entry with him to their Studies.

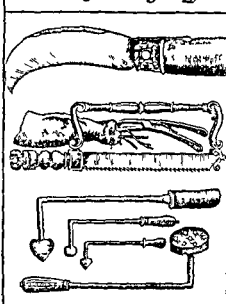
The Whole Collected and Translated  
by Peter Lowe Scottish man  
Doctor in the Facultie of  
Chyrurgery in Paris.



LONDON

Printed by R. Halstons  
Anno Domini 1655

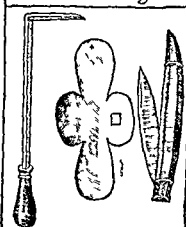
*Instruments and Cutters actuals for extraction*



Of R. c. l. u. LIB V 105

with the same in place of the instrument  
of the same kind for the same purpose  
as the other is used for the same purpose  
the same is used for the same purpose  
the same is used for the same purpose  
the same is used for the same purpose

*Instruments to cauterize and open  
the rest to tender the tongue*



# THE SURGEON'S LIBRARY

## OLD MASTERPILCES IN SURGERY

By ALFRED J. BROWN, M.D., F.A.C.S., OMAHA, NEBRASKA

A DISCOURSE OF THE WHOLE ART OF SURGERY BY PETER LOWE SCOTTISHMAN

THIS work by Peter Lowe is one of the most delightful surgeries ever written. The man is so genuine and soul bound in what he has to tell that his personality dominates his every word and the reader feels as if he were listening to the author and is hearing a pleasant and interesting speaker rather than reading a book. Though Lowe had but little to offer that was new or original, he had had every opportunity of studying the methods of the time and knew how to classify his knowledge and what was still more valuable, possessed the ability to put it out in clear and pleasant style. Born in Scotland, probably in Errol, in 1550, he left there at an early age and received his education in Paris. The value of this early training and the soundness of the French method evidently greatly improved him for many years later he used it to great advantage. After receiving his education he practiced in France and Flanders for twenty-two years. He then passed through the war period of his education where he came in contact with the methods of Franco and Paré and absorbed the good of each. In 1589 and 1590 he was Surgeon Major to the Spanish Regiments at Paris and then as he says next following the French King (Henry IV) my master in the wars 6 years where I took commodities to practice all points and operations of Chyrurgery. Upon which occasion I endeavoured myself to collect my practises at vacant hours into this Book according to the opinion of the ancient and learned practitioners in Phisick and Chyrurgerie in such plain terms as I could for the use of the common sort which now I doe offer to these newly corrected and enlarged for thy greater comfort.

The work under the title *A Discourse of the Whole Art of Surgery* etc. was first published in 1596 when he had returned to London where he remained until 1598, a new edition appearing in 1597. He republished the book in 1612 writing a new dedication epistle to the reader and letter to Gilbert Primrose and James Harvie. After the author's death the work was reprinted twice, the final edition appearing in 1654. The work thus had a life of 58 years.

While in France, Lowe was appointed doctor in the faculty of surgery at Paris and ordinary surgeon to the French King and Navarre. In 1598 he returned to Glasgow and there took up the cudgels for medical

education and licensure. Clowes and Bannister had preceded him by a few years and the question of putting down the quacks and itinerant surgeons was a very live one in the British Isles. In his letter of 1612 to Primrose and Harvie, Lowe takes this up and only space prevents me from quoting his remarks in full. They are so well worth while. He divides the quacks into eight or nine different classifications and then goes on to describe the various types. The upshot of the matter was that in 1599 the matter being considered and the abuse weighed by his majesty and Honourable Council, thought not to be tolerated for the which I got a privilege under his Highnesses privie seal to try and examine all men upon the Art of Chyrurgerie to discharge and allow in the West parts of Scotland who were worthy or unworthy to profess the same. He also received from King James IV the royal privilege to found a school of medicine based on the pattern of Parisian medical education and in 1599 as the result of this the Faculty of Physicians and Surgeons of Glasgow came into being. The date of his death is given as late in 1612 or early 1613. His introduction and letter are dated December 20, 1612, which must have been very shortly before his demise.

Lowe's book follows the stereotyped outline of books of the day and in part is written in question and answer form. Peter the father acting as interlocutor and John his son answering the questions. One of the most interesting things in the book is his clear and concise description of an amputation one can almost see the operation going on. He makes a distinction between clean and infected amputations in so far as hæmostasi is concerned in clean he used the ligature in infected the actual cautery. He also strongly urges that it is better to cut into uninfected tissue and possibly sacrifice some good tissue than try to cleave too close to the line and run the risk of later spread of infection. He scrapes away the periosteum and performs an aponeurotic amputation.

Appended to the 1634 edition is Lowe's translation of Hippocrates which appears under the title *The Presages of Divine Hippocrates*. The presages or prognostications are preceded first by a dedication dated 1611, then follows Lowe's translation of the Hippocratic oath, fuller and in some ways more interesting than the version in common use today and finally a short life of Hippocrates. The work was evidently intended for use by the students in the newly founded medical school in Glasgow.



Diathermy with the use of the Corbus thermophore in early epididymitis relieves pain and shortens materially the length of disability.

We hoped that radium and X ray would offer us a non mutilating agent to attack cancer without the shock of operation but they have not proved so satisfactory as we anticipated. If they are no more than caustic agents actual cautery would act more quickly.

Diathermy because of its slow cooking or dehydration of the tissue is perhaps the most valuable agent that we have against cancer. The results of treatment of bladder carcinoma are very satisfactory. In a series of 28 cases treated by diathermy in the past 5 years 12 are free from recurrence after 2½ years and 7 after 4 years. Cancer of the prostate is treated by exposing the gland through a perineal incision and placing the electrode in immediate contact with the fascia of Denonvillier or by inserting the needle electrode into the depths of the carcinomatous area. Cancer of the prostate is the most difficult problem that confronts the urologist. The results obtained by this ingenious method will be observed with interest.

The authors emphasize that although the book is essentially for the urologist the general surgeon will find that the principles of technique can be applied to cancer elsewhere in the body.

The text is clear and concise and sufficient clinical hints are cited to elucidate their point of view. The book is well illustrated so that the urologist or general surgeon will find little difficulty in applying the technique advised.

JAMES A. CARRER

THE first edition of the work of Czerny and Heller published almost 20 years ago has been recognized by students of pediatrics everywhere as an outstanding contribution to the nutritional problems of infancy and childhood. In the foreword to the second edition the authors state with justifiable pride that their earlier writings have stood the test of time and that in bringing out a new edition they have found their task to be that of making such alterations and additions as recent research has demanded.

How well their work is being accomplished is shown in the first volume of the collection. It deals with the nutrition of the normal infant and child including chapters on chemistry, anatomy, physiology and metabolism. Numerous charts and tables reinforce the text. References to the literature on almost every page show how critical has been their study of the investigation of other workers.

To attempt in a brief review any comment upon the subject matter would be futile. It is enough to say that all those who have followed the pioneer work of Czerny and Heller will be glad to find that their studies of these matters embodied in a new volume.

STANLEY C. BROWN

From the Department of Pediatrics, University of California, Los Angeles, California.

THE many changes in and additions to our knowledge of that relatively young science which has to do with those micro-organisms causing disease requires frequent revisions of any book covering that science. The eighth edition of Park and Williams' *Pathogenic Microorganisms* which includes bacteria, molds, yeasts and protozoa successfully meets such a necessity. To this end many parts of this book have been rewritten and numerous additions made. The grouping of different bacteria has been changed to meet the classification proposed by the Society of American Bacteriologists and the terminology advocated by this society used together with the older and more common names. Well worthy of note is the incorporation of a table giving the essential characteristics, reactions and pathogenesis of most of the pathogenic microorganisms which should be of considerable assistance to students if used with intelligence. The section on immunity has been revised and as is to be expected one finds here an authoritative presentation of the present status of diphtheria prevention and specific treatment. The extensive investigations stimulated by the World War on bacteria of war wounds and gaseous gangrene has called for many additions to the chapter on pathogenic anaerobes.

J. A. DAY

EVERY able treatment of the subject of X ray therapy in surgical conditions is presented in Juengling's book which contains the latest X ray methods used in German roentgenological clinics. The author describes the methods which have proved of particular value and gives a detailed analysis of X ray dosimetry as applied to superficial and deep seated lesions. The biological results of the radiation of the human cell is very extensively presented and there is much concerning experimental investigation on cellular reaction to this medium. The author takes up the various organs in special discussions on reactions to various types and formulae of X radiation. He warns against X ray damage in certain instances and particularly stresses the dangers of radiating malignancy of the larynx and the immediate neighborhood, this being one of the instances in which a pre-operative radiation should not be done which is contrary to the advice found in some quarters. The anatomical cross section diagram method of dose administration is a feature of this work. In the clinical applications of the roentgen ray the author presents much instructive material concerning the benefits of this medium and details are given of successful results in a number of surgical conditions not considered possible in many American clinics. The work covers the field very thoroughly.

JOHN S. BLAINE

From the Department of Surgery, University of California, Los Angeles, California. By William H. Welch, M.D., Ph.D., and John H. Thompson, M.D., Ph.D. The book is published by the University of California Press, Berkeley, California. The book is published by the University of California Press, Berkeley, California. The book is published by the University of California Press, Berkeley, California.







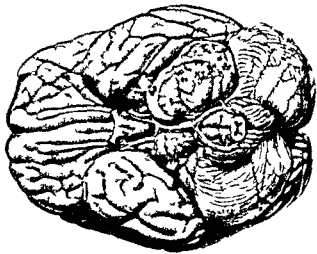


Fig. An example of the growth of the medulla from the medulla. The growth of the medulla is shown in the figure.

In the figure, the growth of the medulla is shown in the figure.

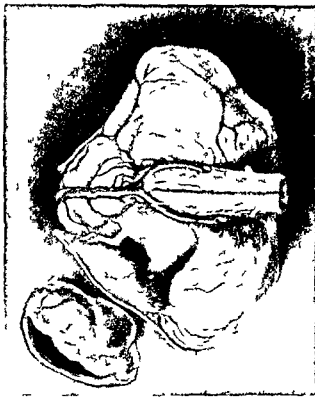


Fig. A section of the brain showing the growth of the medulla. The growth of the medulla is shown in the figure.

In the figure, the growth of the medulla is shown in the figure.

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## AN OPERATION FOR THE TOTAL REMOVAL OF CEREBELLOPONTILE (ACOUSTIC) TUMORS

By WALTER E. DANDY, M.D., BALTIMORE

F. M. H. D. P. A. M. T. (S. G. R. Y. T. H. J. H. H. P. K. H. O. S. P. I. T. A. L. I. S. T. Y.)

POTENTIALLY benign lesions usually easy of recognition not difficult of operative approach or even of enucleation nevertheless tumors of the cerebellopontile angle<sup>1</sup> have presented surgical problems which have seemed well nigh insuperable. Surely few lesions have enticed surgeons with more alluring prospects and have ultimately yielded so little reward for their best efforts for with few chance exceptions patients have succumbed following total or attempted total extirpation of the tumor. At the beginning of the twentieth century it seems probable that there had been but one tumor of this kind completely and successfully extirpated—one removed by Ballance (2) in 1894 and reported in 1907. Although there is some uncertainty as to the exact nature of this tumor (he terms it a fibrosarcoma) it seems highly probable that it was really one of the true cerebellopontile variety. It was clearly an encapsulated tumor in this region, shelling out readily

with the finger and the patient's survival for many years is alone sufficient evidence to preclude a sarcoma. Moreover as most of these tumors in earlier years have been recorded as gliosarcomata—a classification well justified by the histological picture—such an entry is evidence in favor of the tumor being of the cerebellopontile variety.

At the beginning of the twentieth century cerebellopontile tumors were recognized by their more or less characteristic signs and symptoms and became a fairly well established clinical entity. Oppenheim of Berlin, Sternberg of Vienna, v. Monakow of Zurich, Hughlings Jackson and Gowers of London, Babinski of Paris, and Allan Starr of New York, were not only pioneers in the recognition of these tumors but they stimulated a group of surgeons to undertake their removal.

At the International Congress of Medicine in London in 1913 the three great European surgeons—Horsley of London, v. Eiselsberg of Vienna, and Krause of Berlin—who had in such large measure been responsible for the birth and growth of brain surgery, presented their results on the extirpation of cerebellopontile tumors to that date. Horsley had 10 operative deaths in 15 cases (67 per cent), v. Eiselsberg 13 deaths in 17 cases (77 per cent), and Krause 6 deaths in 31 cases (84 per cent). Krause admitted they yielded the poorest results of all his brain tumors. There seems

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bell p i h ry t gr B h p l ted m bec se d  
bad f h t m o s r y l d loc h b h  
orig f h bet t m o s r y l d loc h b h  
m r s f h t m o s r y l d loc h b h  
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rr p b v d d r m bell po l m h t h m f

to have been no very great difference in the methods of attacking the tumor. Each used a unilateral cerebellar approach often little more than an enlarged trephine opening and the tumor was quickly shelled out with the index finger or spatula. Because of the disastrous results the operation was often performed in two stages particularly by v Eiselsberg and Horsley. Sometimes Krause used suction to draw the tumor from its bed.

The conference ended with no prospect of better operative results in the future. In the hasty and necessarily blind extirpation of these tumors through a totally inadequate exposure many of these tumors were broken and only partially removed. Necropsy revealing more or less tumor undisturbed. More over those few patients who survived were almost without exception badly crippled. So far as I am aware the ultimate results of the few successes of Horsley, Krause and v Eiselsberg were never published but a fortunately timed publication of Tooth (18) at the same International Congress in London 1913 presents a comprehensive statistical study of the operative results in all brain tumors from the National Hospital of London to the date of this conference (1913) and appended thereto is a brief summary of each case together with the operator, operation and so far as known the ultimate results. If not including all of Horsley's work this report at least gives us a fair insight into his results. From this dismal story we learn much concerning the fortitude of these great pioneer brain surgeons who nevertheless persevered to blaze a trail through a forest which must have seemed utterly impenetrable. Looking back it is clear that they were ill equipped for such a struggle until the latter part of their work surgery was yet in its infancy. Cranial surgery offered technical problems foreign to those of other tissues instruments of special character had to be devised the control of hemorrhage from bone the brain and tumors was unlike that elsewhere. A knowledge of the functions of the various parts of the brain and of the cerebrospinal fluid was only slowly accumulating. The effects on intracranial pressure of the immediate injury to cerebral tissues were at best imperfectly understood and the avoid-

ance of trauma continued to be almost impossible because technical difficulties prevented sufficient exposure of the desired field. Moreover sepsis continued to exact a not inconsiderable toll. Though Horsley, v Eiselsberg and Krause were all firm adherents of the Listerian principles of combating infection the avoidance of infection had not been mastered. And last but not least neurology was also just developing so that the diagnosis of tumors was usually made when the patient was blind and often *in extremis*. Cerebello-pontile tumors however had one great advantage over all other brain tumors not only could fair diagnosis and localization be made with fair accuracy greater as time passed but the tumor was known beforehand to be benign and encapsulated. The surgical problem therefore was direct.

With a minimum of scientific equipment the struggle for solution of this surgical problem was necessarily in large part through trial and error but the great Horsley early added to neurological surgery the far reaching and invaluable method of animal experimentation but shortly before begun by Fritsch and Hitzl in Germany and by Ferrier in England.

One hardly knows whether to admire the indomitable courage of the surgeon or the persisting faith and hope of the neurologist the more. The story contained in these struggles differs only in degree from that of the pioneer efforts in advancing the frontiers of knowledge. It is therefore without possible taint of a critical attitude that the statistics of Sir Victor Horsley are studied. Without his contributions both technical and physiological to this field of surgery—his bone wax his method of controlling hemorrhage with pieces of excised muscle and his introduction of decompressions in order to combat acute post-operative intracranial pressure etc—it would not yet be possible to cope with the many problems of intracranial surgery.

Returning to Tooth's analysis of operation for tumor we find under the heading *Extracerebellar Tumours—Removal of tumour complete or partial* 1 cases of cerebello-pontile tumor operated upon by Horsley<sup>1</sup>

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From this group of cases 5 (42 per cent) survived the operation for periods of 6 weeks 2½ months 3 years 3 years+ and 8 years+ of these 3 died of recurrence at the times stated 1 had signs of recurrence at the end of 3 years (the wound was bulging and tight) and the last case was well and active 8 years after the operation Of the 7 deaths (58 per cent) 2 were from meningitis on the sixth and seven-teenth days It is evident that Horsley has included in his own mortality statistics two deaths which occurred at 6 and 10 weeks and included in his living cases one which lived 11 months after removal of a tumor on one side and died following extirpation of a second growth in the other angle a case almost surely of Recklinghausen's disease and not of cerebellopontile tumor But the most important result in Horsley's series is not his mortality rate but the report of the necropsy findings Of six necropsies in only one case had the tumor been totally extirpated the remaining five showing more or less tumor still undisturbed In two cases the cerebellar lobe had been very badly damaged

Tooth's remarks on the results following extirpation of these tumors (including 5 cases operated upon by other surgeons at the National Hospital without a single recovery) well express the situation and faint degree of hope at that time The diagnosis of tumours in this region is so comparatively easy and accurate and the surgical treatment at first sight so straightforward that the results in this table are disappointing in the extreme No doubt the proximity to the vital centres is accountable for great shock with respiratory and cardiac failure If the danger of that period can by any alteration in surgical procedure be eliminated there is no reason evident why these cases should not do well

Nor had this impression of the surgical treatment of cerebellopontile tumors changed in England during the following 10 years if we

may judge correctly from the following quotation from Gordon Holmes (11) when discussing a case presented by Walshe (20) before the Royal Society of Medicine It was perhaps presumptuous on his part to refer to the surgical treatment but so many of his cases had passed through the hands of surgeons that he had had some experience in the matter He had seen one case recover only after gross removal of the tumour a man upon whom Sir Victor Horsley operated many years ago but though he lived for several years he was seriously crippled 1 The danger seemed to be that total removal necessarily meant a disturbance of the vascular supply on the same side of the pons and medulla the man to whom he referred had after the operation the characteristic symptoms of softening in the lateral side of the pons He saw a few other cases which had survived operation for a week or so after total removal of the tumour and all show evidence of acute bulbar involvement

The aggregate number of total extirpations of these tumors with recovery to date and freedom from recurrence is impossible to estimate but with liberal allowance it will probably be less than half a dozen—and we are positive of only two Foremost of these cases is the one removed by Ballance (2) in 1894 Apparently the only permanent sequelæ of the operation many years later were palsies of the fifth and seventh nerves the former had resulted in corneal ulceration and loss of vision in that eye The second undoubted cured case is that of Horsley From Eiselsberg's series (9) of four recoveries (including one by his assistant Clairmont) from the operation one was able to resume work on the farm but there is no other record noting the ultimate results and freedom from recurrence Leischner (13) collected from the literature eleven cases which had survived operation Among these were four from Eiselsberg's Clinic one of Horsley's (this was before Horsley's report (1913) of five recoveries) Krause (12) one Poppert (16) one Baisch (1) one and Borchardt (3) three This ensemble however is of little significance they should not be confused with cures for aside from the

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cases of Ballance and Horsley and possibly the one of Eiselsberg, the subsequent evidence of their cure has not appeared. In the light of the necropsy reports in Horsley's cases in which but 1 of 6 cases was shown to be totally removed it would appear fair to presume that few if any of these had been totally extirpated and the patients permanently cured. One of the best results reported in this group of tumors was by Willy Meyer of New York (14 1912). In two stages 4 weeks apart this tumor was removed with a spoon. Three years later he was apparently well but we have been unable to find subsequent notes on this patient's condition.

The operative method used by all operators was essentially the method of Horsley v Eiselsberg and Krause. A two stage procedure came to be used almost universally and usually the dura was not opened in the first step. It seems probable however from Tooth's reports that Horsley always opened the dura and toward the last at least his decompression was bilateral. The unilateral exposure of the affected side of the cerebellum was used by Krause and v Eiselsberg. Krause (12) it is true suggested a bilateral cerebellar approach but it was designed for exploration of the posterior fossa and was not intended to be used when the tumor was known to be in the cerebellopontile angle. It appears that in many instances the opening in the occipital bone was but little larger than necessary to insert the finger or spatula. The tumor was removed by sweeping the finger or spatula around the tumor and making the traction necessary to dislodge it. The finger was preferable for it could better detect the cleavage plane between tumor and brain stem. After such extirpations furious bleeding must have been inevitable. Always the lobe of the cerebellum was injured often much of it destroyed and at times even deliberately removed. Not infrequently the tumor was extirpated through a transcerebellar defect which reached the upper surface of the tumor. Frazier (10 1905) indeed urged deliberate resection of the outer part of the cerebellar hemisphere and though a heroic procedure it probably caused no greater damage to the lobe than that which customarily resulted from these extirpations.

Krause (12 1903) introduced a very useful procedure to reduce the excessive pressure which was nearly always present with cerebellopontile tumors. A trocar was passed through the tentorium into the lateral ventricle permitting the evacuation of its fluid. This procedure (ventricular puncture) in much more refined form has come to be a most important item in all operations for tumors below the tentorium.

Perhaps the translabyrinthine approach suggested by the otologist Panse (15 1904) should be mentioned in passing. At the time this method was proposed attempts to remove cerebellopontile tumors appeared utterly futile and any suggestion might at least be tolerated. But it was a wholly impractical suggestion. After destroying much of the petrous bone including the labyrinth and much of the mastoid bone and its contained air cells and after passing through fields which could not be sterilized and might well harbor dormant infections the resulting exposure must necessarily have been so meager that it would hardly be possible to do more than nibble at these great tumors. Quix (17 1911) hastily reported the removal of a pea sized tumor by this method but the patient died a few months later. The usual large recess tumor was present its surface had only been scratched. The one prerequisite of any operative approach is adequate room to afford thorough inspection of the tumor during its attack in order to permit the deliberate control of hemorrhage. This exposure being lacking in the translabyrinthine approach other consideration of the procedure is useless.

Inevitably a severe reaction must appear against attempts to remove cerebellopontile tumors particularly as the gamut of possibilities both of method and of individual skill had apparently been run. All of the accumulated technical advances of a quarter of a century had made no improvement in the results. At any rate the continuance of an operation carrying such an astounding mortality after such an exhaustive trial was impossible.

The reaction came with the publication in 1917 of Cushing's (5) important monograph on acoustic tumors and with it a revolution in

treatment. He accepts the only conclusion which the foregoing results and experiences of his own could justify, i.e. I doubt very much unless some more perfected method is devised whether one of these tumors can with safety be totally enucleated. He no longer attempted to enucleate these tumors totally but was content to offer a method by which the tumor could be *partially* removed (intracapsular enucleation).

Cushing's contribution is the only important advance in the treatment of cerebellopontile tumors. For the first time the patient was offered a relatively safe surgical procedure with prospects of temporary relief and prolongation of life in lieu of a hazardous and desperate effort carrying permanent disability in the wake of the very occasional chance recovery. In the first series of operations his mortality rate was reduced to 35 per cent and in a subsequent series of about equal number to 11 per cent.

But intracapsular partial extirpation is far from satisfactory for the growth must always recur. Partial removal of the tumor even when the growth develops slowly can never be considered a final operation for a potentially benign tumor.

#### THE DEVELOPMENT OF AN OPERATIVE PROCEDURE FOR THE TOTAL REMOVAL OF CEREBELLOPONTILE TUMORS

The purpose of this communication is to present an operative procedure by which it has been possible to remove the entire cerebellopontile tumor in a group of cases. Admittedly it is a procedure of magnitude and carries potentialities of great danger. However with care and attention to detail the mortality may not be greater and not improbably even less than Cushing's partial intracapsular enucleation. The method has been gradually evolved from the failures of other operative procedures. Finally it was forced upon us in an effort to avert an impending death several days following the partial (intracapsular) operation.

Our operations on cerebellopontile tumors cover the past 9 years. At the present writing the series consists of 23 tumors the results of which are included in Table I under the vari-



Fig. 3. D. W. Goetz's section of the brain showing the tumor. The tumor is shown in the middle of the brain, between the two hemispheres. It is a large, rounded, lobulated mass, and is attached to the brain by a stalk. The tumor is shown in the middle of the brain, between the two hemispheres. It is a large, rounded, lobulated mass, and is attached to the brain by a stalk.

ous methods of operative attack. One case apparently well on admission died at stool a few hours before the time scheduled for operation. In a general way the order of the grouping is also chronological though this is not strictly true. Our operations began at a time (1915) when the results of attempted enucleations were known but our efforts were necessarily directed along the more or less generally recognized methods of operative attack. The initial attempts at a simple suboccipital decompression met a sharp and entirely un-





Fig 4 (left) Patient 3 years after total removal of cerebellar tumor. She has been living happily. Figure 5 (right) Patient 5 years after removal of tumor. She is healthy and happy.

Figure 6 (left) Patient 8 months after removal of tumor. She is healthy and happy. Figure 7 (right) Patient 1 month after removal of tumor. She is healthy and happy.



Fig 6 (left) Patient 8 months after removal of tumor. She is healthy and happy. Figure 7 (right) Patient 1 month after removal of tumor. She is healthy and happy.

expected reverse and dispelled at once our pre-existing impressions of the value of this procedure as a palliative measure. Two cases so treated died within 12 hours postmortem examination revealing no hemorrhage or other cause in either instance. Although the intracranial pressure was well advanced in both patients each was conscious and in good physical condition at the time of operation. Disregarding for the moment the explanation of these deaths—now better understood—it is at least evident that this comparatively simple procedure has been accompanied by great danger and has in nowise helped to solve the problem of removing the tumors.

In desperation our next effort total extirpation with the finger at one stage then seemed the only alternative. It was of course merely a reversion to the well tried and fruitless method of Horsley, Krause, Eiselsberg and others. Nor was there reason to expect better results. After two initial successes four deaths in succession showed the futility of further attempts. It is of little concern that one case is well 5 years later and the fate of the other after leaving the hospital is unknown. The results are of interest and importance only in that their careful analysis did explain the causes of death and therefore suggested method of avoiding them.

At this time of despair Cushing's method of intracapsular enucleation was introduced. Its great improvement over other procedures was at once obvious. Despite enthusiastic hopes however our first experiences with intracapsular enucleation were unfortunate in being less satisfactory than had been anticipated. Following an uneventful and quick recovery from the effects of the operation the first patient 7 days later became listless and drowsy, vomiting, dysphagia and dysarthria appeared and during the succeeding 3 days all symptoms became progressively worse and finally alarming. The late appearance of these symptoms seemed to exclude the postoperative complications which might have been expected hemorrhage or infection and suggested that in some way the reaction about the stump of tumor which remained was responsible for the condition. The wound was reopened and the shell of tumor extirpated with the index finger. There was surprisingly little hemorrhage which was readily controlled. The patient's condition then steadily improved. Diminished drowsiness was at once apparent the vomiting at once ceased and 5 days later she was able to swallow. From the result of this case it seemed logical to infer that if the shell of the tumor could in some way be removed at the first operation this stormy and dangerous course following subtotal removal might be avoided. In the succeeding cases in which the tumor has been removed at one sitting the result has amply supported this inference.

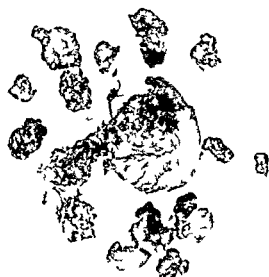


Fig. 8. Fragment of tumor removed by intracranial method. The large mass is the capsule, which protrudes through the dura mater. The most important part of the tumor is the capsule, which protrudes through the dura mater. The capsule is the most important part of the tumor. The capsule is the most important part of the tumor. The capsule is the most important part of the tumor.



Fig. 9. Group of fragments of the tumor removed by the method. By dissection the capsule is removed from the tumor. The capsule is the most important part of the tumor. The capsule is the most important part of the tumor. The capsule is the most important part of the tumor.

#### THE OPERATION (6)

Needless to say the success of this procedure is dependant not only upon many technical advances which have been slowly accumulating but also upon a clearer understanding of intracranial physiology and pathology. Without Horsley's bone wax or Cushing's silver clips without Horsley's principle of decompression to take care of post-operative traumatic oedema without the bilateral cerebellar exposure (probably originated by Cotterill<sup>4</sup>) which allows more room for exposure and for decompression and finally without Cushing's intracapsular method of removing the body of the tumor the removal of the capsule of the tumor could hardly be accomplished.

A bilateral cerebellar approach which has become more or less a regular practice for all cerebellar lesions is first made and the bony and dural defect extended laterally and superiorly on the side of the tumor as far as the transverse and lateral venous sinuses will allow (Fig. 11). Because of the great depth of

the tumor an ordinary bilateral cerebellar approach alone would not afford the direct inspection and lengthy manipulation which is necessary to dissect the growth from its bed. Indeed in a survey of Cushing's cases there are instances in which the tumor was missed at the first operation because of insufficient exposure and there are other cases in which the tumors were found only by transecting the cerebellar lobe. Attempts to expose the tumor with an insufficient removal of bone causes serious injury to the brain from retraction. Always the mastoid cells are brought into view but unless the easy exposure of the tumor make imperative demand their entrance is avoided. But when opened the cells are at once covered either with a sheet of wet cotton or by reflected dura (Fig. 12) which is sutured to the galea or trapezius muscle. The history of a mastoid infection would give great concern and every other possibility of the tumor's exposure would be attempted before yielding to an easier approach which open



Fig. 1. Roentgenogram (top) showing site of surgical approach. Thymic gland (bottom) showing tumor.

ing hitherto infected cell would provide. The anterior part of the bony extension is carried under the attachment of the trapezius muscle but the continuity of this muscle with the galea is carefully preserved. A good exposure of the entire superior surface of the cerebellum is important in providing a good exposure of one large vein (Fig. 11) which bridges the space between the superior surface of the cerebellum and the tentorium which it enters en route to the transverse sinus. Unless ligated and divided beforehand this vessel may easily be stretched and torn in elevating the cerebellar hemisphere and in exposing the tumor. There is less danger of such injury to the contralateral symmetrical vein and similar precautions against its injury are not necessary. Needless to say special care is taken to avoid incising either the lateral or sigmoid sinuses particularly the latter.

Almost without exception the dura has been so tense that it has been necessary or at least advisable to relieve pressure in the dilated ventricles tapping and withdrawing

fluid from the posterior horn of a lateral ventricle. Hydrocephalus invariably results when the tumor has occluded the iter (Fig. 3) and few tumors appear for operation before this phase of the tumor's progress is well established. Before removing the ventricular needle gentle pressure can, if desired, be applied to the intact dura and additional relief of pressure which is exerted upon the posterior fossa will follow the further escape of fluid which is afforded by the upward push of the tentorium. In every case of hydrocephalus from cerebellar lesions the intracranial pressure above the tentorium can be reduced to that of the atmosphere by this simple expedient and without danger of injury to the brain stem.

After this preliminary measure gentle elevation of the cerebellar lobe quickly brings the tumor into view though at a great depth (Fig. 12). Another invariable finding in all cases of cerebellopontile tumors is the partial or complete obliteration of the cisterna magna, the cerebellar tonsils projecting through the foramen magnum into the spinal canal (Figs. 11 and 12). If however the cisterna does still contain fluid its release again contributes that much more room to the all important exposure of the tumor. An encapsulated bed of fluid (having no communication with the subarachnoid spaces) may or may not crown the outer and superior surfaces of the tumor and though largely or entirely obscuring the tumor its presence is almost as characteristic of an underlying cerebellopontile tumor as the direct inspection of the neoplasm itself. Further elevation of the cerebellum brings the unattached outer surface of the tumor into full view and into a position where it can be subjected to an operative attack. Excepting the poles which have passed beyond the confines of the posterior cranial fossa (through the incisura tentorii and the foramen magnum) the entire longitudinal extent of the tumor is brought into full view. The capsule is then incised longitudinally from pole to pole (Figs. 12) and much of the outer contents removed piecemeal with a curette after the method of Cushing (Fig. 13). The capsule is then picked up at the margins of the opening in the tumor drawn forward with forceps and the attached surface of the capsule brought into view.

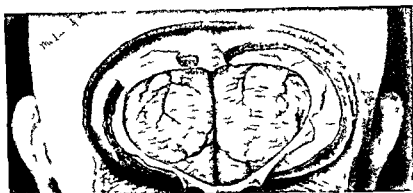


Fig. 14. The only defect of the usual lateral cerebellar approach considerably enlarged on the side of the tumor as far as the lateral sinuses. The capsule is removed on the right and cut the middle lobe is removed to obtain the view. The capsule of the dorsal third of the middle lobe is removed to obtain the view of the tumor.

(Fig. 14) The contents of the tumor are then curetted with the brain stem and cerebellum always fully exposed. Continuing this method the capsule gradually becomes thinner and when drawn forward permits inspection of the cleavage line between the brain stem and capsule of the tumor. When the poles of the tumor have invaded the middle cranial fossa and the spinal canal removal of their interior allows them to be easily withdrawn into the posterior fossa such polar extensions of the tumor are least adherent to the brain stem. Gradually in this way the entire capsule is separated from the brain stem. As the capsule is cautiously retracted several small blood vessels crossing from the brain stem or cerebellum are brought into view and doubly clipped and the vessels divided. Practically all bleeding can be forestalled in this way (Fig. 10).

Removal of the capsule of the tumor in this way is necessarily very tedious and time consuming. The method employed is but the application of the fundamental surgical teaching of my former chief, the late Professor Hülstedt. By this great master every operation whether unusual or commonplace was performed with the utmost care. All tissues were handled with the greatest gentleness, the field unstained with blood, and a step was never taken blindly. Always his work was painstaking, the field of operation immaculate and hemorrhage minimal. Time of opera-

tion was always subordinate to accurate and thorough performance.

It is clear that as a measure preliminary to removal of the capsule the intracapsular curettement must be carried out much more thoroughly than when this procedure is the end result. When the tumor is curetted blindly, i.e. with only the outer aspect of the growth in view, the total amount of tumor removed though seemingly great will be relatively small for the danger of penetrating the capsule and injuring the brain stem with the curette is always uppermost in the operator's mind and in avoiding this possibility it is more probable that too little rather than too much will be removed. The more thoroughly the capsule is stripped of its solid contents (up to a certain limit) the easier becomes the final stage of its separation from the brain stem. It should not be inferred that the separation of the capsule is not attended by difficulties. It is always difficult and frequently for some time seems impossible. Only by persistently tugging at the capsule, often gaining but a millimeter at a step, does its attachment finally yield.

In one of the earlier cases the ultimate release of a fraction of the capsule seemed impossible of accomplishment and was given up. It is quite probable that with increasing experience and confidence this capsule could now be removed. On the other hand, only quite recently the capsule in another case was so



FIG. 1. The tumor is high (the tumor is) and when the tumor is cut the pressure is not too great. The tumor is not too large and the tumor is not too large.

delicate that at every attempt at traction it tore and when this seemed no way to overcome the difficulty in dissection the capsule was belled out with the index finger. There is never a marked histological difference in the degree of attachment of the tumor to the brain stem and there will probably always be instances in which a deliberate and pain-taking removal will not be possible.

When the capsule is ultimately delivered the denuded brain stem is left and must be perfectly dry. A fatality will almost surely ensue if even the slightest exsiccation when closure is begun. Drainage has usually been avoided though in two instances a rubber protective wick was placed in the lateral recess and removed in less than 24 hours.

The large vessels encountered during the operation are the posterior inferior cerebellar and vertebral arteries which wind around the lower pole of the tumor and usually encircle it. At times two trunks of the tumor are given off from the former. These arteries are but loosely attached to the tumor and can easily be stripped from it after the branches have been divided. At the other pole of the tumor is a large venous branch of the inferior petrosal sinus. Closely applied to the tentorium and the tumor from which it emerges this

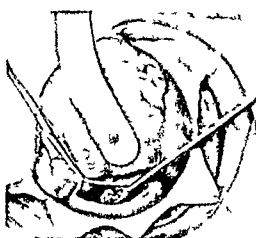
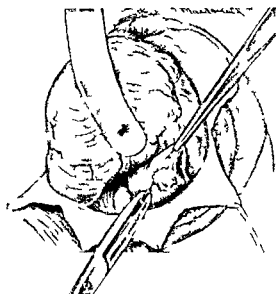


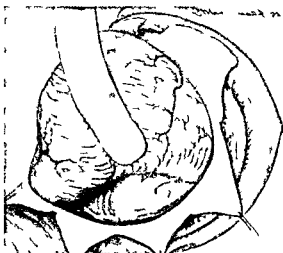
FIG. 2. The tumor is high (the tumor is) and when the tumor is cut the pressure is not too great. The tumor is not too large and the tumor is not too large.

vein may be very troublesome unless dissected free, ligatured and divided in the operation. Naturally these vessels cause greater concern are the arteries which arise from the brain stem to the tumor. There are usually three to six of these vessels in addition to two or three from the inferior surface of the cerebellum. Though constituting probably the greatest danger of the operation there is never no great difficulty either in exposing or heat these vessels.

Removal of the tumor at a single stage is undoubtedly far preferable to two stages. Despite its great length (from 3 to 4 hours) the operation is usually well borne and unless exceptionally difficult can be completed before wearing of the pressure or accelerating pulse gives warning of danger. Only once did the patients' condition necessitate abandoning the operation in the continuing a second attempt. In three cases the capsule was intentionally left for a second stage (7 to 12 days later). In the interim the capsule had become so soft swollen and friable that the teeth of the forceps were no longer able to retain a grip and the capsule then had to be belled out with the finger. If the capsule cannot be carefully extirpated at the first stage its enucleation with the finger can undoubtedly be accomplished with greater safety at a second and not too distant stage for the residual of the tumor which remains doubtless reduces the caliber



1. 4. Illustration of the method of the author for the removal of the tumor. The tumor is removed by the use of the low pole strips the tumor from the brain stem. The tumor is removed by the use of the low pole strips the tumor from the brain stem.



1. 5. Dr. Dandy's method of the removal of the tumor. The tumor is removed by the use of the low pole strips the tumor from the brain stem. The tumor is removed by the use of the low pole strips the tumor from the brain stem.

of the small arteries supplying it and greatly modifies the bleeding.

It is not the purpose of this communication to commend finger enucleation for these tumors. However in those exceptional cases in which the capsule of the tumor cannot be liberated I believe the removal of the capsule at a second stage to be superior in the ultimate and at times in the immediate results to the subtotal intracapsular enucleation alone. An excellent example of this impression is given in the patient previously mentioned. When several days after intracapsular enucleation stupor vomiting dysphagia and dysarthria appeared and progressively increased not only did she promptly recover and the symptoms quickly disappear after enucleation of the capsule with the finger but she has since remained as well as any of the patients in whom the operation was completed by careful dissection in one stage.

The bond between the brain stem and tumor may be solely by connective tissue but in one case at least the tumor has been found at necropsy to be a direct outgrowth of the brain stem (Fig. 3). It can hardly be denied

that when the tumor is actually continuous with and a direct outgrowth from the brain stem its origin must be from the brain stem and not from the region of the porus acusticus as has been claimed. But the origin of these tumors is another story which we shall consider at another time. The capsule has always been most adherent at the pons in the single case in which a line of cleavage could not be followed throughout the fragment of tumor remained tightly adherent at the pons.

Cerebellopontile tumors are only slightly adherent to the dural covering of the base of the skull but the separation of the capsule nearly always leave an oozing raw surface and at times an even greater degree of bleeding. At the porus acusticus however the attachment is always firm for the auditory nerve is an integral part of the tumor. This attachment has usually been liberated after the tumor has been separated from the brain stem but in one case the dissection was begun at the meatus and in so doing it was possible to pick up and follow the facial nerve in the capsule in which it was superficially located to the brain stem. But in liberating the capsule from the pons the nerve was accidentally torn. Greatly elongated by its stretch around the tumor the facial nerve in this case was a

very delicate filament scarcely larger than an ordinary cambric sewing needle. In none of the other cases has the facial nerve been seen during dissection of the tumor. Should preservation of the facial nerve with total removal of the growth be ultimately possible, it could doubtless be more easily located at the internal auditory meatus. Its course is probably always as in this case on the under surface and toward the lower pole of the tumor.

The trigeminal nerve is always brought clearly in view during the dissection and throughout its intracranial course (Fig. 15). Usually it first appears when the upper pole of the tumor is withdrawn from the incura tentum or separated from the tentorium. But on one occasion when the dissection from the inferior pole proceeded with unusual ease the nerve was first exposed at its junction with the pons; its exposure was then continued forward in the direction of the midbrain. Being tightly squeezed between tumor and brain stem which it parallels (Fig. 2) the trigeminal nerve has been flattened like a ribbon. Its more distal course is determined by the upper pole of the tumor which pushes the nerve ahead; oftentimes into the middle cranial fossa causing it to double back upon itself before entering the dural envelope surrounding the gasserian ganglion.

The remaining cranial nerves of the posterior cranial fossa (on the side of the tumor) though pushed aside and even somewhat elongated by the tumor are much less seriously affected. Before the dissection is started the spinal accessory nerve (most affected of this group) is often seen bending around the inferior pole of the tumor from behind but in any case it is quickly brought into view when the inferior pole is drawn forward. The vagus and glossopharyngeal nerves appear in succession when the inferior pole is drawn a little farther forward. Never more than lightly attached to the growth the e nerves are pushed mesially and inferiorly the distortion of each depending upon the size and configuration of this part of the tumor. In one case a tumor nodule projected between the spinal accessory and vagus nerves. The hypoglossal nerve having a more mesially placed exit is less disturbed by the tumor. This entire

group of nerve fall away as the capsule of the inferior pole is dislodged (Fig. 14). Although the basilar artery has been exposed on two occasions I have never recognized the abducens nerve.

We have carefully examined every porus acusticus after extirpation of the tumor but in only two instances was there an appreciable widening of this opening. Not infrequently there was a rather diffuse concavity of the region surrounding the meatus and in one instance a quite deep pit (about 1 by 1 centimeter and probably 3 millimeter deep) with fairly abrupt walls extended mesially from the porus and included its inner margin but the outer margin remained unchanged. These findings explain the lack of positive changes in roentgenograms and they also constitute evidence against the theory of origin of the tumor in the internal auditory meatus. When the tumor has extended into the porus its liberation has not been difficult. Only on one occasion was it necessary to chisel away the outer margin of this opening before the dissection could be completed.

With one exception the operations have been performed under ether anesthesia. Novocain worked admirably in this exception until the brain stem was reached when the pain became so severe that ether was given for the capsular dissection. The patients are maintained in the horizontal face down position. Pulse and blood pressure readings have been the best criteria of the patient's condition and largely determined whether the operation could be concluded in one or two stages.

#### POSTOPERATIVE COURSE

Low brain tumor extirpation runs a more uneventful and satisfactory course than these have done. Without exception the patients have quickly become conscious have remained so and on the following day have appeared free of danger. That two of the series of total enucleations should have survived a superimposed purulent meningitis (*streptococcus viridans* and *staphylococcus aureus*) the symptoms of which appeared 48 hours after the operation indicates the rapidity of recovery from the operation. The postoperative temperature curves of the patients are more

or less uniform. The rectal temperature slowly rises to a maximum which is usually reached in 10 or 12 hours and it almost as quickly descends to a level around 101 or lower the next morning. Usually the maximum temperature is about 103.6 to 104.2 though one case reached 104.8. At the end of the operation when the patient is coming out of ether the quality of the pulse will be at its worst and the rate highest. Despite the gradual post-operative rise of temperature the patient remains conscious and the pulse slowly falls usually reaching 100 to 100 on the following morning.

Of the series of 5 cases in which the capsule was carefully removed (all in one stage) post-operative dysphagia was present in only one patient and she had been unable to swallow for 36 hours before the operation. Five days later nasal feedings were discontinued. In all of the four cases in which the capsule was *enucleated with the finger* nasal tube feeding was necessary but in two of these patients inability to swallow had developed 7 and 10 days after a subtotal intracapsular enucleation (first stage) and was therefore not caused by the operation. The one death in this series was from pneumonia (eighth day) and was doubtless induced by aspiration during this period when swallowing was difficult. Surely this death could now be avoided. Fluids are now withheld from patients after operation until they are well able to swallow in the interim the regular nasal feedings are substituted.

Each of the five cases was able to walk out of the hospital with support and to some extent alone the time of departure being 16, 18, 18, 25 and 76 days after operation. One patient was unable to walk when she entered the hospital because of a partial hemiplegia (there was also dysphagia) resulting from the tumor's indentation of the brain stem 22 days after the operation she walked across the room without support. The protracted stay of the patient who remained in the hospital 76 days was due to a postoperative streptococcus viridans infection which was cured by cisternal drainage. Fortunately this patient has retained no ill consequences of the infection.

#### SUBSEQUENT COURSE OF PATIENTS AFTER REMOVAL OF TUMOR

There has as yet been no recurrence but the longest time since operation has been only 3 1/2 years. Every patient is well free from headache and has been able to return to work. The one outstanding sacrifice of the operation is the hemifacial paralysis (Fig. 4). It has as yet been impossible to preserve the facial nerve though I am not so sure that this may not eventually be possible. The reason for this hope is that in one case (previously mentioned) the facial nerve was dissected from the porus to the pons but was finally inadvertently torn when the capsular dissection was continued. The patient is informed of the necessary loss of the facial nerve beforehand and is given the choice of an intracapsular curettage of the tumor. With a spinofacial or hypoglossofacial anastomosis however the degree of this deformity has been greatly modified (Figs. 5 and 6). Six of the 8 patients have had spinofacial anastomoses and all with returning function. Before attempting an anastomosis the function of the spinal accessory or hypoglossal nerves must be tested in order to preclude union with a nerve trunk which may have been injured at the time of operation.

The auditory nerve being incorporated in the tumor and totally paralyzed before the operation is irretrievably lost. This of course holds equally true when intracapsular enucleation is performed. The trigeminal nerve has been injured at operation in each of the 5 cases but sensation has returned to a more or less degree in every instance. In the three finger enucleations the trigeminal function has been destroyed in two and only injured in the third. Ulceration of the insensitive cornea is a danger which must be guarded against by shielding the eye. In one of the eight cases enucleation of the eyeball was finally necessary and in another vision in the affected eye was lost following healing of the ulcer. The danger of this complication is the same as that following resection of the posterior root of this nerve for tic douloureux. With the improved methods of prevention now in vogue corneal ulceration should become a less disturbing factor.



In every case there has been dizziness and consequently balance of the body has been disturbed but always there has been a steady and progressive improvement. It is probable that this disturbance may be the result of retracting the cerebellum—a factor which should be lessened as our skill in removing the capsule improves. A very light weakness and stiffness of the hand on the homolateral side has persisted in 6 cases and in two recent cases (2 and 6 months) after finger enucleation of the capsule the affection is more pronounced. Soon after the operation there has at times been some slight subjective stiffness of the corresponding leg but this has soon entirely disappeared except in the above two cases of finger enucleation. Doubtless this slight residual disturbance is the result of injury to the pyramidal tracts in the brain stem and for this reason the arm fibers presumably are situated more externally than the fibers for the leg.

Table II indicates in a general way the results obtained in these patients to date. While the time is too short to refer to the absence of recurrence, the enucleated character of the tumor and its total removal should leave little doubt that they will not recur. It may again be emphasized that the determination of the total removal of the tumor is not by guesswork but by a careful inspection of the site of the growth at the end of the operation. It is at once evident that the results following finger enucleation are in comparable (excepting the latter) to those following painstaking removal of the capsule.

#### EXPLANATIONS OF THE MORTALITY FROM VARIOUS PROCEDURES

At first glance it must seem incredible that the total removal of a cerebellopontile tumor can be accomplished with even less mortality than that following the relatively simple curettement of only part of the tumor's interior. It cannot be reasoned that because an operation is simpler it is better and safer. The simplest operation for these tumors is a cerebellar decompression but it has been attended by the highest mortality in the hands of nearly every operator. The reason for these seemingly paradoxical results is the

simple one of cause and effect. If the patient's condition will justify the additional effort there is no relief so quick and so complete as that following removal of the cause. There are occasions when the effects of the cause can be relieved by a smaller and less dangerous palliative operation (decompression) but that is only true at times. There are many intracranial tumors which can never be even lightly benefited by any form of palliative procedures and under such conditions the procedure itself becomes an insult added to an already overstrained intracranial pressure. Cerebellopontile tumors offer seemingly insuperable obstacles to the success of the customary palliative operation in the late stages of the tumor effects.

The high mortality from the simple enucleation of cerebellopontile tumors with the finger or fistula is now readily understood. Death results from injury to the brain stem when the finger tears the tumor from the brain stem and from picking the denuded brain stem in the frantic effort to check hemorrhage. An examination of the brain after death in one of our cases showed the lateral margin of the brain stem softened and minute hemorrhage extending almost to the midline in the pons and medulla. This finding is not surprising since immediately after the tumor is shellled out there are always symptoms and signs which serve as telltale indicators that the medulla has been injured. At once respiration ceases for many seconds (often a minute or more) after which they reappear irregularly and with serious embarrassment and after several minutes they usually become more or less normal. However after a severe injury the respirations may remain irregular, difficult and ineffective or apparently they may even fail to reappear though it has never occurred in our cases. But even when the respirations seem to have become satisfactorily re-established a secondary phase of embarrassment is almost sure to reappear 4 to 8 hours later. It seems probable that this may be a secondary reaction (edema) of the tissues to the initial trauma. The phase of secondary reaction is characterized by harsh, slightly irregular and more rapid respirations, the pulse rate accelerates

and diminishes in volume the temperature rises steadily the reflexes diminish and the patient becomes progressively more difficult to arouse Obviously precisely the same effects are produced when the brain stem is compressed by hemorrhage

Is there such a high mortality following a simple suboccipital decompression in the presence of cerebellopontile tumors? It would often be a great comfort to be able to do a simple bilateral suboccipital decompression and complete the removal of the tumor at a subsequent stage but for reasons which are only now clear the mortality is almost as high from this operation alone as from enucleation of the tumor This danger is shown not only by our own two deaths (100 per cent) but by Tooth's reports which incorporate the results of Horsley's operations From a series of 7 verified extracerebellar tumors there were 4 deaths within 15 hours a fifth died of respiratory distress on the sixteenth day and the remaining two of meningitis It is significant that only one of these tumors was actually disclosed at operation but all were verified by necropsy There was therefore no trauma to the tumor and the contiguous brain stem to account for the high death rate More recently Trotter (19) has commented upon the dangers as well as the uselessness of suboccipital decompressions for cerebellopontile tumors a view also voiced by Gordon Holmes Surely these figures are far too high but the results could never be reduced far enough to make this operation a commendable procedure In Cushing's series the results following decompression were very much better there was only 1 death in 10 cases in which a cerebellar decompression was done but another patient survived only after a desperate struggle in which artificial respiration was maintained for an hour The reasons for the excessive mortality in decompressing these tumors will be evident if the pathological changes which accompany the tumor's growth are understood and again those alterations which must suddenly be induced by removal of the occipital bone and dura

Cerebellopontile tumors not only deeply indent the brain stem (reducing its bulk as much as one fourth or even more) but dis-

locate it to the opposite side causing its normal straight mid axial line to become a pronounced curve But this great defect and alteration in the brain stem are tolerated because the changes have been so gradual It is even remarkable that no appreciable disturbance of function can usually be detected by our clinical tests

Most cerebellopontile tumors are small in comparison with cerebral tumors or even with other tumors in the posterior cranial fossa Although the posterior compartment is small the actual bulk of the tumor is not difficult of compensation by (1) partial obliteration of the cisterna magna the cisterna pontis the cisterna beneath the mid brain and the fourth ventricle (2) herniation of the tonsils of the cerebellar lobes into the spinal canal (through the foramen magnum) and (3) by pushing the tentorium cerebelli upward (7) Were it not for a new factor which inevitably supervenes as the tumor grows life could doubtless be maintained for a much longer time by these adjustments<sup>1</sup> This new factor is closure of the aqueduct of Sylvius When this small channel becomes closed by the anterior extension of the tumor hydrocephalus involving the third and both lateral ventricles inevitably results It is only with the onset of hydrocephalus that the real intracranial pressure develops The pressure caused by the hydrocephalus always develops rapidly and soon overcomes the space adaptations which had previously been consummated in the posterior cranial fossa it also quickly reduces to a minimum nature's remaining reserves of space compensation Though quite firm tough and inelastic the tentorium cerebelli is gradually pushed backward reducing the space in the posterior cranial fossa These qualities of the membrane however must be of great service in temporarily protecting the contents of the posterior cranial fossa and to the tentorium is doubtless due the preservation of life pending the advent of

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bu h bec m da du d dly l g ed y ral mes h  
righ t r cr i pa f f so b t y t most ly  
u n f t d p ec f f

Tb te t wh h th t or um h be tr icked be roughly  
m t d by h a p es ur th u h wh h ca be ec d f m  
tr l needl wh p es ur th u h wh h ca be ec d f m  
bella t muph es

surgery. Without doubt the danger of cerebellar decompression is proportionate to the degree of hydrocephalus which is present at the time of operation.

*What happens when the occipital bone is removed and the dura opened widely cerebellar decompression?* Removal of the occipital bone at once liberates the pressure in the posterior cranial fossa. But this benefit is at once countered and may be greatly exceeded by the injurious effects of the backward pressure on the tentorium (hydrocephalus) and its full force is now exerted without opposition upon the delicate brain stem jamming it backward. It would seem that this force must be exerted almost entirely through the incisura tentorii for the tentorium itself would hardly be sufficiently elastic to stretch so quickly as to produce these disastrous results.

It must not be inferred that the results following suboccipital decompression are the same for all tumors in the posterior cranial fossa. Variations result from differences in the character, position and fixation of the tumor. Almost complete relief of all symptoms will at once follow suboccipital decompression when a cerebellar cyst is evacuated. And ofttime even when a cyst has not been evacuated or an intracerebellar tumor not removed the same complete but temporary relief will be obtained. For the backward displacement of the tumor may be great enough to relieve the obstruction at the aqueduct of Sylvius. But cerebellopontile tumors (and some other growths in the posterior fossa) are so firmly fixed to the floor of the skull that displacement of the tumor cannot occur. Therefore no relief of the hydrocephalus can be expected from decompression. Moreover the cerebellar tumors nearly always extend from one end of the posterior fossa to the other and are closely attached to the brain stem throughout. Indeed as noted before they often extend posteriorly through the foramen magnum into the spinal canal and anteriorly through the incisura tentorii even at times far enough anteriorly to destroy the posterior clinoid process. Not infrequently however a relatively small cerebellopontile tumor produces more severe and fulminating manifestation of

intracranial pressure than larger growths because a small projecting nodule of the tumor imbeds itself deeply into the side of the mid brain causing the aqueduct of Sylvius to be obstructed.

There can be no doubt that many of the obstructions of the aqueduct and fourth ventricle have a ball valve action. This can be shown by the fact that at one time the intraventricular pressure will register very high on a succeeding day it may be normal. In fact one can easily be misled into assuming the absence of a neoplasm by finding a normal intraventricular pressure. The pressure may be low mainly to the particular stage in the cycle of changes resulting from the ball valve action of the tumor. Such vacillations in pressure are impossible in tumors which have infiltrated the aqueduct. They are most frequent in mobile non-infiltrating tumors and are of intermediate frequency in fixed non-infiltrating tumors such as the cerebellopontile group. Periodical relief from pressure of this character is doubtless less frequent in obstructions of the aqueduct than of the fourth ventricle because the channel of the latter is so narrow.

It does not seem possible that the hydrocephalus could be relieved by any lateral displacement of the brain stem away from the tumor in the tentorial opening. For usually the tumor has filled the superfluous space in the incisura tentorii at least in the lateral aspect and any anteroposterior displacement of the brain stem can hardly have any effect other than to make any partial obstruction of the latter complete.

The injury resulting to the brain stem from the supratentorial pressure probably bears a close analogy to that following two other well recognized procedures often erroneously considered harmless. Severe medullary embarrasment and even death are not rare sequelae of a lumbar puncture performed in the presence of high intracranial pressure. Death or other injurious effect in these cases is surely due to the injury inflicted upon the brain stem when by the release of the intracranial pressure the cerebellar tonsils are suddenly driven more deeply through the foramen magnum into the spinal canal. One of the patients in

our series was in coma from this ill advised procedure

The other example of the danger of disturbing established pressure relations is shown when lumbar punctures are performed in the presence of certain spinal cord tumors. In a not inconsiderable percentage of cases sensory and motor function and sphincter control will be quickly affected even lost after lumbar puncture (8). In nature's effort again to equalize intraspinal pressure after lumbar puncture in the presence of a complete spinal block the higher pressure above the tumor can only spend its force by jamming the spinal cord against the immobile tumor. Unless the tumor is situated in the high cervical region these injuries to the spinal cord affect only function whereas the analogous (though greater) effects of supratentorial pressure on the medulla in the presence of cerebellopontile tumors compromise life as well as function. We believe therefore that when the dural and bony support of the occiput is removed (suboccipital decompression) the supratentorial pressure pushes the brain stem backward through the incisura tentorii until its force is spent also that this injury to the brain stem is probably augmented by the tug on the firmly fixed cerebellopontile tumor. The degree of this damage is probably proportionate to the grade of intracranial pressure and the size of the tentorial opening (the fixation of the tumor is probably fairly constant).

*Why should a suboccipital decompression plus intracapsular removal (subtotal) of a cerebellopontile tumor be less dangerous than a suboccipital decompression alone?* The fact that the mortality rate in these tumors has been reduced only by the advent of Cushing's intracapsular method of enucleation is ample evidence for the assertion contained in this interrogation. When the interior of the tumor is sufficiently removed the capsule will be freed of its rigid support thereby permitting the obstruction of the aqueduct of Sylvius to be released. The supratentorial pressure (of hydrocephalus) which is the real dangerous factor in these operations will be automatically relieved as effectually for the time being as if the tumor were removed. But one of the greatest defects of subtotal intracapsular

enucleation is the difficulty of removing the proper amount of the contents of the tumor to permit this benefit to accrue. Unless the tumor is thoroughly removed so as to leave a fairly empty capsule the remaining tumor will be essentially as rigid and immobile as the original tumor and there would then be little if any relief either to the laterally deflected brain stem or to the hydrocephalus. During the removal of the contents of the tumor with a curette only the outer surface of the growth is brought into view and one has great difficulty in knowing indeed it is usually impossible to determine the depth of tumor which still remains imbedded in or projecting beneath the brain stem. The importance of this determination we have learned from completely shelling out the interior of the tumors as our deliberate total extirpations now necessitate. Curetting the interior of the tumor with the brain stem in the background necessarily demands caution and in playing safe usually more tumor remains than seems possible from the apparent size of the exposed stump. In one of our two-stage extirpations 18 grams of tumor was curetted away and we thought but little was left with the capsule. The remainder of the tumor when removed at the second stage weighed 26 grams!

Since hydrocephalus results from occlusion of the iter and since hydrocephalus is one of the chief factors in the operative mortality it is safe to infer that the part of the tumor demanding urgent excavation is the upper pole. Otherwise the hydrocephalus cannot be relieved. One of Cushing's necropsy specimens (Case xix) shows the upper pole of the tumor practically untouched by the intracapsular removal.

The configuration of the tumor also has something to do with the amount of tumor *in situ* after a subtotal removal. Nodules may project into the brain stem from the inner side of the tumor. It has seemed that these deeply imbedded and invisible localized masses at times cause more symptoms referable to the brain stem and play a greater rôle in obstructing the aqueduct of Sylvius than the big bulk of the tumor. The effect of the nodules will not be greatly if at all influenced by removal of the outer portion of the tumor with a curette

Unless one is acquainted with the technical steps in a bilateral cerebellar operation it would be reasonable to question why the brain stem has not already been injured by the supratentorial pressure during the operation when the dura is opened widely. This pressure however is always under control. Puncture of a posterior horn of a lateral ventricle is always utilized to reduce the supratentorial pressure to that of the atmosphere. The period of great danger to the patient when the hydrocephalus has not been relieved is in the few hours succeeding the operation—when the intraventricular pressure is again re-established.

*Will it should there be less mortality after subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor than from the partial removal alone?* From this series two deaths were surely impending about 2 weeks after partial intracapsular enucleation of the tumors and were finally prevented by removal of the remainder of the tumor at that critical period. The defects of the partial operation therefore really forced the total removal of the growth. In every case in which a subtotal intracapsular operation has been performed (6 in all if those cases are included in which the intracapsular method was the first stage) the immediate postoperative course has been perfectly satisfactory. It has been several days later when the patient should have been out of danger that the alarming symptoms developed. In some was the stump of tumor caused the important functions located in the brain stem to be seriously compromised. We know from the gross appearance at the second operation that the stump of tumor which remained was swollen and friable doubtless owing to nature's method of repair but in all probability the same changes were also present in the contiguous brain tissue and were responsible for the symptoms. Whatever the exact explanation may be complete subsidence of all symptoms at once followed extirpation of the residual tumor and capsule. No such complication has appeared in any of the cases (5) in which the entire tumor has been removed at one sitting.

A careful survey of the results after various operative attacks brings us to one general

conclusion with proper care and attention to detail that operation which at once removes the cause (other things being equal) not only carries the lowest mortality but at the same time offers incomparably the best immediate and permanent results.

TABLE I.—KIND OF OPERATIONS AND RESULTS

Kind of Operation	Number of Cases	Recovery	Death	Cause of Death
1. Total removal	5	5	0	Died before or after operation
2. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
3. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
4. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
5. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
6. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
7. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
8. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
9. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
10. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
11. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
12. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
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92. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
93. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
94. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
95. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
96. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
97. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
98. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
99. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations
100. Subtotal intracapsular enucleation of the tumor plus removal of the remainder of the tumor	6	6	0	Operations

#### OPERATIONS ON PATIENT IN COMA FROM THE EFFECTS OF (XEPH) LIPOSTILE TUMORS

There is one exception to the above generalization concerning the removal of the tumor in patients in coma from this type of tumor.

I have excluded from the operative mortality of total extirpations two patients who entered the hospital when totally unconscious and who were operated upon while in this state. One patient had been unconscious 8 hours the other 3 when the operation began and in each there was Cheyne Stokes type of breathing. Furthermore in the first instance the location of the growth was entirely unknown until determined by ventricular estimation. The treatment if any for such cases I believe distinctly a different problem from that which obtains when patients are in coma from tumors situated elsewhere in the cranial chamber. When patients are comatose from

TABLE II—END-RESULTS  
CASES WITH RECOVERY AFTER CAREFUL REMOVAL OF CAPSULE

	Age	Time Since Operation	G t	B l	Arm d l g affected de	R m be g t	A	V N	Head hes	Wt	Remarks
MR IV I	40	yr	Walk 2 1/2 miles per day Feel safe with support	Still feel dizzy but improving	Leg well Arm d h d	Slight	N g	Sensation fully restored	N	+	Postoperative meningitis (tuberculous) Cerebral drainage
TH II	56	yr	Walk well	Slightly dizzy	Stiffness both legs normal	Slight	N g	Slight or malbalanced posture	N		
FB III	44	yr	Can walk 4 miles without support Feels dizzy enough to get out of bed	Still slightly affected but gradually improving	Head slightly affected	N g	N g	Partial sensation restored	N	+81 +5	Healed oronasal ulcer Lateral resection
JM IV	9	1/2 yrs	Excellent walk or down stairs with support	Perfectly normal	Still slight weakness of right arm and leg	Slight	+	Somewhat better sensation restored	N	-25	Was unable to walk before operation Head slightly swollen
IR V	36	1/2 yrs	Can walk and work without support	Still feel slightly	Very slightly less normal	N g	N g	Not quite normal	N	Same	

CASES WITH RECOVERY AFTER INTRACAPSULAR ENUCLEATION FOLLOWED BY FINGER EXTIRPATION OF CAPSULE

FL VI	5	1 1/2 yrs	Can walk and dance	Only occasional blurring	None	Very slight weakness	N g	Normal bowing of thumb	N	+5	Two-stage operation
RLB VII	8	6 mos	With support but requires help	Very marked difficulty	Good grip but clumsy	Mildly paretic	+	Sensation restored	N	+4	Ulcerated severely much better Small tumor few weeks before symptoms first
WD VIII	3	mos	On discharge from hospital walk without support Finger motion normal No hydrocephalus	Very marked difficulty in balance	Mildly affected	Mild paretic	+	Sensation restored	N	ne	Postoperative meningitis (tuberculous) meninges resulting hydrocephalus cured completely Lasted 6 months series weight 6 gm Two-stage operation

NOTE.—As in II (the patient's condition before operation) is compiled from answers to letter inquiry. Some of the light cases have had postoperative meningitis.

intracranial pressure it is often possible to restore consciousness by a palliative properly placed decompression and at times the tumor may even be safely removed while the patient is still unconscious all of course depending on the depth and duration of coma and the location and character of the tumor. In many such cases it is incumbent and preferable only to relieve the intracranial pressure immediately and the removal of the tumor can await a second stage if advisable.

But as said before coma from cerebellopontile tumors is not amenable to relief from any form of decompression. Even when the patient is quite conscious and in good condition a suboccipital decompression is tantamount to a mortality in the advanced stages of intracranial pressure. The realization of the futility of operative palliation in these tumors urged the more radical attempt at removal of the tumor after first curing the interior. Despite the fact that the extirpation

was easy and bloodless in both instances consciousness was not restored there was no relief and death followed within a few hours. In such cases we are dealing with a brain stem already severely injured before the operation began and any operation entailing even the slightest additional injury (such as the removal of the tumor must necessarily exact) could not be tolerated even with relief of the supratentorial pressure.

Whether the partial intracapsular procedure would ever be successful under such conditions one can only conjecture. Realizing as we do now the underlying differences between the coma of these and other tumors it would surely have been wiser to have decided though the results would hardly have been different. This particular phase of the problem seems very dismal from our present knowledge and experience. I fear some new and totally different line of attack must be evolved if any results are to be expected in such cases. One great difficulty in these comatose patients is the differentiation beforehand of the kind of tumor though its location in the posterior fossa may be clear. For tumors other than the cerebellopontile variety (such as intracerebellar tumors) a cerebellar decompression would always be indicated and would frequently prove effective treatment. When the character of the tumor has been determined only by operation one is faced with the problem of proceeding with operative treatment. And when patients in coma from the effects of cerebellopontile tumors have been subjected to operation decompression alone will surely be fatal one can hardly do less than perform the operation devised by Cushing and surely not more.

#### SUMMARY

An operative procedure is presented by which cerebellopontile (acoustic) tumors can be completely removed. After a thorough and carefully guarded intracapsular enucleation

the capsule of the tumor is painstakingly dissected from the brain stem.

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## END-RESULTS IN ONE HUNDRED CASES OF ANTERIOR POLIO MYELITIS OPERATED ON AT FORDHAM HOSPITAL

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**S**INCE the epidemic of 1916, our knowledge of anterior poliomyelitis has increased a great deal. Although we have not as yet found the definite and specific cure we can claim that by following proper orthopedic treatment many of the sequelae can be abated. Many patients can not only be relieved of their deformities but even be made to walk and work without being handicapped to any great extent. Varied operations have been invented. Many have already fallen into disuse. Almost every orthopedic surgeon develops a favorite operation and follows his cases carefully; others however attempt every new operation and so have no chance to compare the results.

In their report the Committee of the American Orthopedic Association which was appointed to standardize stabilization operations of the ankle showed the value of certain operations and the uselessness of others. Operations on other joints have not been investigated as yet. Final results of operations performed in hospitals of high standard as a rule are published from time to time. Such reports are of course extremely helpful to those interested and it should be the duty of every surgeon to go over his final results from time to time and publish them. A frank review will be of great service to him as well as to the readers.

After reviewing my first hundred operations on patients suffering with anterior poliomyelitis performed at Fordham Hospital since January 1917 I thought it advisable to publish my finding. The year 1917 was chosen by me as a starting point because at that time following the epidemic of 1916 the after care had been better carried out and the results could be judged more correctly. In addition many cases from previous epidemics were submitted at that time for operation. Thus the results on new as well as old cases could be properly tabulated.

### GENERAL OUTLINE OF THE WORK

All the patients included in this report were treated by me at the orthopedic clinic of the Fordham Hospital out patient department before admission to the hospital.<sup>1</sup> In the recent cases the ordinary treatment such as massage, muscle training and braces was given for some time before the patients were submitted to operation. In the old cases very often for a short time only treatment was given to develop certain muscles or accustom the patient to the clinic routine until a hospital bed was available. In other cases marked deformities had to be corrected at once before treatment was instituted.

Most of the patients therefore were observed by me before operation and a proper diagnosis was made. Every operation herein reported I performed personally and thus eliminated one factor which might lead to a difference in results. Having performed the operations myself I feel that I am in a better position to watch the results.

After their discharge from the hospital patients were treated at the out patient department under my care and were examined by me from time to time. If necessary the patient was readmitted for reoperation or for another operation. Within the last few weeks the majority of the cases have been re-examined by me so that the final results are more nearly correctly stated.

I have not tabulated the reasons for the choice of operation in each case. It is implied that in each case the operation chosen was in my opinion the type of operation indicated. If the result was not what could have been expected and if the technique or after care was not at fault I consider that the operation performed did not meet the requirements (Table I).

<sup>1</sup> b t Fordh m Hosp tal geon t d f N w York City I will tat  
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TABLE I—CASES OF ANTERIOR POLIOMYELITIS TREATED AT FORDHAM HOSPITAL

N	P t	Kind of operation	General impression	Remarks	N	P t	Kind of operation	General impression	Remarks
	A D	Astraglectomy	Good		7	D Z	Fasciotomy of p. tarsal fascia	Good	
	R G	Tenodesis of posterior tibial ligament	Fair		8	M C	Subcutaneous myofasciotomy	Good	
	R B	Bed rest	Good	Lost track of patient	9	R S	Subcutaneous notomy of flexors	Good	
	N M	Astraglectomy	Good		10	A H	Osteotomy of tibia	Good	
5	H V	Astraglectomy	Good	Reoperation necessary; wound not properly formed; due to neglected infection	11	A H	Osteotomy of tibia	Good	
6	D S	Astraglectomy	Good		12	R P	Tenotomy of posterior	Good	Softer operation & better
7	C G	Subcutaneous myofasciotomy		Lost track of patient	13	R C	Stretch and not achill	Poor	Reoperation of Astraglectomy performed
8	H E	Tracheostomy	Good	Lost track of patient	14	M P	Tenotomy of tibia	Good	
	B P	Tracheostomy	Good		15	M P	Tenotomy of tibia	Good	
	A D	Arthrodesis of knee	Good			J T	Subcutaneous tenotomy of achill	Good	
	E B	Stripped	Good		17	H W	Tracheostomy	Good	
	M C	Bismuth force of hip	Good		18	M S	Corrected loose of previous tracheostomy	Good	
1	M P	Tracheostomy	Good		19	M h	Tracheostomy		Lost track of patient
4	R	Arthrodesis of shoulder	Poor			T h	Arthrodesis of myofasciotomy	Good	
5	R P	Stripped	Poor			D G	Subcutaneous	Good	Most had error of position. Severe error of hip & very good result
6	A V	Astraglectomy	Fair			G R	Tenotomy of plantar fascia and notomy of toe	Fair	
7	H H	Tracheostomy	Good			J C	Subcutaneous tenotomy of plantar fascia and notomy of achill	Good	
8	S B	Stripped	Good	Lost track of patient		H T	Tracheostomy	Good	
9	H V	Subcutaneous notomy of tibia	Good		1	H V	Tracheostomy	Good	
	D M	Tenotomy of posterior	Good			F E	Astraglectomy	Good	
	R G	Astraglectomy	Good		4	J J	Astraglectomy	Good	
	H V	Astraglectomy	Poor	Had been operated on elsewhere	5	E h	Astraglectomy—right	Poor	Case escape of infection
3	J M	Astraglectomy	Good	Examination of patient		R P	Subcutaneous—right	Good	
	A H	Subcutaneous tenotomy of tibia	Good						
5	E D	Stripped	Good						
6	M K	Stripped	Good						

TABLE I—Continued

N	Patient	Kidney	General impression	Remarks	N	Patient	Kidney	General impression	Remarks
5	R P	So t er a—l ft	Good		75	F M	S ndler	Good	
5	H D	Ope t tomy ft d ach ill Jones rans pl latio lex so gus hall is	Good		76	J S	Left tr g lect my	Good	
5	J J	So tte ight ad	Good		77	H G	ndler a nd J es l ft	Good	
5	D G	So tter igh D loc two correct d	Ex ll t	Same pati t Case A l d standing er or pol my lit D bl S t t E cell t es lt	78	E K	Transpl tatio f left loc ps	Good	
54	M L	Astragalec my f l ft foot	Good		79	S M	T my ft nd bl t d transpla t f pe on t sc ph d	Good	
55	M C	Cun ilform osteotomy f righ femur	Good		8	A F	A trag lectomy	Good	
56	J J	Left trag lect my	Good		8	L S	Right trag lec my	Good	
57	A H	Astragalec my	Good		8	E K	R pl m t f foo ba kw d from prev rag lec my D vi per t	Good	
58	R C	A g l t my te don fira son	Good		83	E P	Ri ht trag lect my	Good	
5	M C	Sou ter l ft b p	Good		84	M C	Tra pla t t f gh fuc tel f r q drac ps	Good	
6	R G	Astr g lect my	Good		85	H v	D f ight d t b d t t tra lec om y	Good	Heel d wn th floo
6	M L	S bcu so osteot my f mur	Good		86	C C	Astr g lect my	Good	
6	P A	dler		Low track t pa	87	J B	T pl tat f b ps f qu dr ps	Good	
63	A D	J es pe tio f te soe l gus halluc nspia ta so	Good		88	F W	S iler d J nes	Good	
64	M L	M pulat m f m l nion f th osteo o my f C se 6	Good		89	B W	A tr lect my	Good	
65	M C	Right astrag lec my	Good		90	M C	B ps int q d ps l f	Good	
66	E K	Left tr g lectomy	Good		9	I Z	S dler d J es	Good	
67	J B	Left rag lect my	Good			I Z	R m l of xost a b om	Good	
68	S G	Astr g lect my	Good		9	C M	Ope t t my ft d h ll tre h f pl ta f sc	Good	
69	R C	So tter h	Good			A V	R h lec m	Good	
7	M L	Wh m loop igh	Pos	Ded by ce f bu h f ra poor		J	S l ta pou t my f l ft	Fir	
7	G B	A tragalec my	Good		96	R S	Left tra lect my	Good	
7	R G	Arthrodex f bouid	F lur			J W	R gh tr lect my	Good	See footnot
73	P P	Wh ma loop righ	Good		98	A M	Left tragalec my	Good	
7	M F	A lec om	Good		99	F A	Righ astra lect m	E cell t	
	J W wa	m f b h d f l paralys Ad er h		ag f y ner sel tr m	99	M h	Left ope le rth h llus g f	Excell t	

## THE AFTER-TREATMENT

The after treatment consisted usually of the application of plaster casts and braces massage and muscle training. However the poor results could not always be attributed to poor technique or unfortunate choice of method of

operation as many of these patients did not follow the directions faithfully. Anyone who is acquainted with an out patient department knows how hard it is to carry out any preconceived plan. Still we can learn a great deal from such deficiency. An operation that has

TABLE II—END RESULTS IN 100 OPERATIONS FOR ANTERIOR POLIOMYELITIS

Opera	N um ber per formed	Functional result				Anatomical result				Functional results compared with expected as in table 1 in percentage						Remarks
		F	Good	F	Poor	Ex	Good	F	Poor	5	60	7	8	90	100	
OPERATIONS IN THE REGION OF THE FOOT																
Amputation	Cases	3	0	3				3					3	8		7
	Percent		5	3		3	33			0	3	6	6			
Distal posterior double amputation	Cases	3		3				3								
	Percent			3				3								
High amputation	Cases			5												Immobilized foot. Loss of track of patellar. A second operation case.
	Percent			50												
Excisional amputation	Cases	5														Immobilized foot. Loss of track of patellar. Second operation case.
	Percent															
Open amputation	Cases															
	Percent															
Proximal amputation	Cases															
	Percent															
Distal amputation	Cases															Immobilized foot. Loss of track of patellar. Some incurable disease.
	Percent															
Excisional amputation	Cases	3														
	Percent			67									33	3		33
Excisional amputation	Cases															Immobilized foot. Loss of track of patellar.
	Percent															
Excisional amputation	Cases															
	Percent															
Excisional amputation	Cases															Immobilized foot. Loss of track of patellar.
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TABLE II—Continued

Operation	N. times per foot	Functional result				Anatomic result				Final result compared with per cent of total terms of percentage						Remarks
		F	Good	Fair	Poor	F	Good	Fair	Poor	1	50	7	6	90	100	
OPERATIONS IN THE HILFER																
Arthrodesis of ankle	1															Immediate loss of function
Arthrodesis of shoulder	1															
Arthrodesis of hip	1															
Arthrodesis of knee	1															
Arthrodesis of elbow	1															
Arthrodesis of wrist	1															
Arthrodesis of ankle	1															
Arthrodesis of shoulder	1															
Arthrodesis of hip	1															
Arthrodesis of knee	1															
Arthrodesis of elbow	1															
Arthrodesis of wrist	1															

proved a success in a clinic case would give of course better results in a private case.

#### SYSTEM OF TABULATION OF END-RESULTS

Instead of tabulating the results as excellent, fair, and poor, I have considered them under four separate headings, viz. (1) functional, (2) anatomical or aesthetic result, (3) final result as compared with the expected result, and (4) duration of time under treatment. We then subdivided the first three into excellent, good, fair, and poor.

1. *Function.* As most of the patients were children, it was not necessary to assume different standards as is the usual custom with adults, i.e. what may be considered a good functioning foot for a worker is not a good one for a dancer, etc. We considered that the aim of each operation was to enable the patient to walk without a brace with as little limp and discomfort as possible. I regard as the most important factor the functional result. When function has been greatly improved, I feel that the operation has been a success.

2. *Anatomical or aesthetic result.* It is generally acknowledged that many patients (and this is especially true of women) are as conscious about the appearance of an afflicted limb as they are of its improper functioning. It is therefore of medical interest to see whether certain operations improve the aesthetic effect.

3. *End result.* We are often disappointed because the results of an operation do not come up to our expectation. The patient or

the parents are often also disappointed because they have expected too much from the operation. Of course there are occasions when the surgeon is dissatisfied but the patient is extremely pleased as he has a good functioning limb. In his review on end results Brown mentions the fact that in many cases he considered the result poor while the patient was well satisfied. It was therefore worth while to get information from the patient as to his opinion of the expectation and result. Many of the answers were interesting.

4. *Duration of time under treatment after operation.* This could not be ascertained in every case as clinic patients do not come regularly. Some nervous parents brought the children too often and for a rather longer period than was really necessary. Hence a justifiable conclusion can not be drawn from this class of cases.

#### TYPES OF OPERATIONS

The first column in Table II shows the various types of operations. Some of the operations performed are perhaps now obsolete but at that time these operations were in vogue.

Many steps in the operations have been changed from time to time. For instance in the astraglectomies. At the beginning I cut and transplanted the peroneal tendons, then only cut them and sutured, and now I do not disturb them. The reason for these changes in astraglectomy, for instance, is that I have frequently visited the clinic of K. Whitman

and having followed his technique closely have modified the steps of the operation as he changed them. The same holds true of other operations in this series in which the originator in later articles modified the steps of the operation. While many steps of certain operations have been discarded because they were found harmful others have been given up as useless.

The technique I use is the technique employed by the majority of orthopedic surgeons and has been varied according to the advancement made by various observers.

CONCLUSIONS

1 Many complicated operations for cases of anterior poliomyelitis can be performed in a general hospital as well as in a special orthopedic hospital.

2 It is absolutely obligatory that the orthopedic surgeon who operates on a child for deformity following anterior poliomyelitis carry out and personally supervise the after treatments as many valuable operations are discredited because the after care is not properly carried out.

3 For stabilization of the foot astragalectomy is the best operation as to result in both function and shape.

4 After an astragalectomy the muscles throughout the entire lower extremity even the thigh muscles improve immensely.

5 Open instead of closed (subcutaneous) tenotomy should be performed.

6 Transplantation of biceps for quadriceps gives very satisfactory results.

7 Soutter's operation for transplantation of hip flexors is a very useful and satisfactory operation for cases of even long duration.

8 Steindler's operation of transplantation of plantar muscles gives good results but one must be sure to stretch the foot considerably and use a brace for a long time.

9 Gallie's operation of tendon fixation has not given me desired results.

10 Jones' operation of transplantation of the longus hallucis gives good results.

11 Tendon transplantation fails if a weak muscle is expected to do the work of a strong muscle.

I wish to thank the visiting surgeons of Lord's Hospital for their friendly hand given to me. I also desire to express my gratitude to the nurses of the Association for the Crippled Children especially to the director Miss Wilson. They have followed many of the cases and I have traced the results for you.

I also wish to take this opportunity to thank Royal Whitman in whose clinic at the Ruptured and Crippled Hospital I had the privilege of these operations and have benefited greatly by his kind and thoughtful suggestions.

## CEDEMA AND HYPERTROPHY OF THE CERVIX UTERI DURING THE PUERPERIUM

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**T**HE obstetrical complication which is the subject of this article is uncommon. In the medical literature of the last 20 years are found but few reports of the condition and I have seen only two cases since 1896. I wish to make it plain that I refer only to those cases of total enlargement of the cervix uteri and I say enlargement in order not to prejudice the nature of the anatomical lesions that have been observed.

Edematousness of the cervix is very common; is localized in the anterior lip and usually is associated with prolonged labor particularly with an occiputoposterior presentation. Complete edema with neither enlargement or elongation of the cervix is the initial sign of the condition poorly named—*anatomical rigidity*—probably contracted cervix in English. But in the one condition the cervix has a characteristic appearance quite distinct from that seen in the other condition.

If the many unsolved problems that confront us in the pathogenesis of uterine hypertrophies other than pregnancy are borne in mind, no one will criticize us so long as the clinical picture is complete if many things are left unexplained.

**CASE 1.** My first outstanding case was observed early in 1897. One afternoon I was called by Maria Fazio, a midwife, to visit a multipara who according to her report had a uterine prolapse. I found a woman of 30 or 35 years, quite exhausted, who had been in labor since morning with intense labor pain. During pains the cervix turned violaceous and dilated 3 to 4 centimeters with a fetal foot protruding and began to appear and protrude from the vulva. At the height of labor pains the cervix protruded from 7 to 8 centimeters from the vulva and ring.

A cursory examination showed that at the time of greatest prolapse or protrusion the vaginal canal retained practically its normal depth. In the vagina was felt a thick cylinder with smooth walls throughout of the same consistency as the protruding cervix. The cervix was easily dilated by slight traction. I extracted on of fetal twins that appeared to be 75 to 6 months fetus. I promptly a foot of the other fetus presented. This fetus was also entirely ex-

tracted. The placenta was delivered by simple extraction without mishap. Immediately after delivery the contracted fundus of the uterus could be felt about 12 centimeters above the symphysis pubis notwithstanding the fact that the cervix protruded an equal distance from the vulva. The puerperium was normal and 1 month afterward I verified the diagnosis of supravaginal and infravaginal hypertrophy of the cervix without uterine prolapse or colpocele. The patient did not wish to be operated upon.

**CASE 2.** On September 21, 1916, she came to my service a woman, L. F. de M., Uruguayan, 36 years of age, married without any previous illnesses except measles and scarlatina in infancy. Menstruation since the age of 15 had always been regular and abundant; neither sexual relations nor childbirth had modified its character. The general physical examination revealed no organic alterations; the Wassermann reaction was negative. Patient said she had had 4 pregnancies, 3 normal to term and was now in the course of the fourth, having had her last period in January 1916. The uterus had always been normal although for a few days after her last labor in 1913 she felt that her uterus appeared at the vulva but was easily reduced; after a physician had indicated the *modus faciendi*. As she felt better she was not examined again although during this pregnancy she felt a continual sense of heaviness in the perineum. On September 19 she suddenly felt a foreign body protruding from the vulva. She believed it to be the fetus and called to a neighbor, Dr. C., as consultant and he advised her removal to a hospital. It was not possible to find data regarding the initial dimensions of the tumor but she was examined by me on her arrival in the hospital. She appeared to be in excellent general health. Locally examination disclosed a voluminous tumor that emerged from the vulva in the form of a truncated cone the base of which was continuous but without a definite line of demarcation from the thick cylindrical portion—the supravaginal part of the cervix. The mass was resistant about 10 centimeters in diameter in its most external portion, 5 centimeters at the level of the vulva and 12 centimeters from this to the border of the greater base which presented a transverse fissure of 5 centimeters. The commissures were continuous with the remains of the old tears. The mass also presented a series of transverse longitudinal continuous ridges the anterior column of the vagina. The laceration was variable—lateral in the portion a few centimeters gray violet in the part more distant mottled with gray and red spots and covered with islands of false membrane. On the posterior lip

there was an ecchymotic area triangular in form measuring 2 by 1.5 centimeters. The lateral and posterior vaginal space was retained but not the anterior which was completely precluded by the tumor. The tumor was irreducible. On deep palpation the unengaged fetal head could be felt. The body of the uterus had the normal characteristics of a pregnancy 7 to 8 months.

As there was no indication for urgent measures, I chose expectant treatment and after a thorough cleansing applied a pack saturated in Dakin solution changing it frequently. The pulse was 76, the temperature 36.8 degrees C.

September 22. The night passed quietly and the patient stated that she was greatly relieved. The temperature was 36.6 degrees C, pulse 80. Notwithstanding this the local condition became aggravated, the under surface of the tumor was of a grayish green color and the general surface covered with numerous vesicles filled with seropurulent fluid alternating with areas of false membrane.

The rapid progress of cervical destruction induced me to intervene immediately. Operation was performed by Dr. Turfne assisted by Dr. Cortabarría and the anæsthetist Beretche. Ether anæsthesia was used. The patient was placed in the oblique position and the denuded surface of the tumor covered with a field protection. A vaginal circular incision was made flush with the vulva at the level of the lower margin of the bladder. Separation of the vagina from the bladder was simple because of the considerable œdema of the submucous tissues. The supravaginal portion of the tumor was removed 3 centimeters above the incision in the mucosa. The vaginal and cervical mucosæ were united by circular suture and a vaginal tampon of iodoform gauze was inserted. A centigram of morphine was given and repeated every 6 hours.

In the afternoon the temperature was 36.8 degrees C, pulse 92. September 23 at 4.30 a.m. the patient advised the interne Dr. García San Martín that for the past half hour she had felt labor pains in spite of the administration of 1 centigram of morphine. Immediately following this the tampon was expelled and then the fetal head covered with the membrane appeared. The membranes were ruptured and the slow spontaneous delivery of a living female child weighing 2,400 grams followed. The parietal measurements were 8.2 centimeters and the occipitofrontal circumference 2 centimeters. Examination showed the cervicovaginal sutures intact. There was no hæmorrhage. Another iodoform tampon was placed and removed 6 hours later. The temperature throughout the day was 36.6 to 36.8 degrees C and the pulse 100 to 108. The vagina was irrigated with Dakin solution.

September 24. On examination the cervix appeared in good condition. A fetid clot which had been left was removed, a tube inserted and Dakin solution applied by Carrel method. The temperature was 37.5, 38.3 degrees C and pulse 100 to 100. On September 25 the temperature 39.3, 39.6

degrees C, pulse 115 to 104. On September 26 the temperature was 37.5-39, pulse 96 to 62. On September 27 the temperature was 38.4-38.2 degrees C, the pulse 96-92 and lochia was diminished and less fetid. On September 28 the temperature was 38.4, the pulse 88 to 104. The first chill occurred during the night. On September 29 the same treatment was followed locally. It was thought that this might cause localization of the abscess. The temperature was 37.6-39.5, pulse 108 to 100. On September 30 the abscess had become frankly localized. The temperature was 38.4, 40, pulse 104-120.

After this day the course showed a pyæmic trend. On October 1, in spite of the good reaction to the localized abscess, purulent collection appeared in the metacarpophalangeal joints of the left hand. On October 14 phlebitis of the left leg developed but the blood culture was negative. On October 18 the veins of the right leg were involved and the œdema reached the region of the umbilicus. On November 10 the blood culture showed abundant chains of streptococci, the œdema invaded other regions continually extending to higher levels; there was evidence of abundant collateral circulation over the anterior portion of the thorax and also transient œdema of the face and upper extremities. Rapidly there developed an obstinate diarrhœa, delirium, a return of the chill and hyperpyrexia. The patient died on the night of December 6.

At autopsy were found no peritoneal adnexal or uterine lesion. There was an enormous vascularization and venous stasis with abundant exudate in the pleural, peritoneal and pericardial cavities. The histological examination of the amputated section of the cervix showed interstitial œdema and numerous ascarular thromboses with a few chains of streptococci. In the more superficial parts were simple lesions of a chronic inflammatory type.

As is well shown both cases with certain differences in detail have common similar characteristics which leave no doubt as to the existence of a hypertrophic state of the cervix to which in the second case is added a generalized œdema.

Since the unsurpassed work of Huguier vaginal and supravaginal hypertrophy of the cervix has acquired a definite place in our classifications and when associated with prolapse it forms a distinct entity having its own symptomatology. To exclude further the possibility of confusing simple prolapse with hypertrophic elongation I feel compelled to repeat well known ideas and to emphasize the fact that in many cases there is a spontaneous and progressive reduction of prolapse when the uterus becomes an abdominal organ during pregnancy. Under the influence of causes not



well understood however in patients who how a certain predilection to circulatory changes during pregnancy the hypertrophy of the cervix assumes the characteristics of an acute condition and at times this hypertrophy occurs at a stage when there could be no compression or other serious disturbance of the circulation.

Rizzatti (11) saw a young woman of 22 years pregnant 3 months with retention of urine because of a retroversion of the uterus the hypertrophied cervix of which protruded considerably from the external genitalia. The retroversion was corrected and the pregnancy continued to term when labor was induced. Dilatation was effected rapidly and the fetus was extracted with forceps. After parturition Rizzatti amputated the cervix successfully. Such an early appearance of the condition is rare for in the majority of cases it is not observed until the fourth and more frequently the sixth month of gestation. The fact however leads us to think that the introduction of an accidental cause is necessary to make the cervical lesion visible or to constitute it *d'emblee* and is very often the first appearance of the cervix at the vulva. The case of Varrier (17) is an example.

The patient a multipara of 27 years 7 months pregnant suddenly felt on standing a foreign body at the vulva. On examination this was found to be the cervix uteri which protruded 10 centimeters and had a circumference of 25 centimeters. Scratching was made which excited a clear serous fluid these effusions were not painful in the protruded part but painful deep in the vagina. There were no cystocele. In the Trendelenburg position manual reduction was easily accomplished. The following day nothing abnormal could be elicited by touch. Ten days later there was a sudden reappearance of the tumor but again it was easily reduced. Twenty days later there was another relapse but the tumor reduced by simple dorsal decubitus. Labor was normal at term. The nineteenth day it was evident that the uterus was in retroversion 12.5 centimeters with the hysterometer there was no hypertrophic elongation of the cervix. This is a typical case of acute recurrent edema of the cervix.

Often the strain of an exertion is the immediate cause of the condition the 3 cases of Engstrom (4) multiparae in which the edema seems to have appeared after exertion and subsided with rest the case of Seitz (14)

a multipara in which the edema recurred each time there was constipation and disappeared regularly on intestinal cleansing sustain this assertion.

In general the edema without previous hypertrophy has not given place to edema during pregnancy. A tendency to relapse is quite common the case of Varrier just cited is an example. The observation of Paddock (8) presents the same contingency.

A multipara age 35 years in good health having had four pregnancies with normal labors in the fifth month of the fifth pregnancy noted suddenly a fleshy mass the size of a fist protruding from the vulva the edema subsided with the patient in the Trendelenburg position. Several times this occurred but did not impede the labor which was spontaneous and the cervix returned to normal condition. After 2 years in the course of another pregnancy the edema recurred several times and premature delivery took place during one of the attacks. The expulsion had to be hurried because of a hemorrhage but as without untoward results. The tumor disappeared rapidly and the cervix regained the normal state.

#### The case of Jolly (7) is analogous

In this para the first pregnancy was normal these on however normal until the seventh month when without perceptible cause a tumor of the size of a fist appeared at the vulva but disappeared spontaneously in 2 days. At term the tumor returned and was greater in size and did not tend to reduce spontaneously. It reduced slightly but not entirely with patient in dorsal decubitus and the application of hot fomentations. Labor was somewhat difficult but terminated spontaneously. A few days later the tumor had disappeared.

This case much like the preceding one corresponds in certain points with the curious type described by Rouvier (12) in that the edema affected alone the cervical lip giving rise to a polypoid tumor. In analyzing several of the observations cited and others which have been published the following deductions may be made as to the existence of the several clinical types as related to previous conditions of the cervix—conditions which have distinct courses.

1. The acute edematous type in services previously intact has a sudden onset and has a tendency to recur it is easily reduced and has little influence on the course of the pregnancy and labor and the cervix becomes normal after labor.

2 The cervical hypertrophy type is in fravaginal and supravaginal or both previous to pregnancy. In this type the œdema is in significant during pregnancy and has little or no influence on the course of labor save for the tendency to prolong it.

3 The mixed type. Chronic œdema with acute pressure in a cervix previously diseased. Unquestionably this type is more serious since the observations published suggest two problems: (a) Is there a characteristic dystocia of this type? (b) Are operations on an altered cervix justifiable during pregnancy and labor?

Various observations demonstrate the existence of a dystocia.

Case of Shroder Benicke (2). The tumor was 15 centimeters in circumference the head was 6 centimeters from the external cervical orifice. A Barnes bag was inserted. Six hours later the cervix was incised and successive vaginal irrigations were made for fetal condition. Eleven hours after placing the bag two deep incisions were made and the forceps applied and the incisions were extended during the extraction of a living fetus weighing 3,150 grams. The puerperium was febrile with puerperal mania.

Case of Sauvage (13). The patient was 41 years of age. Her first labor was normal in 1888. The second pregnancy was in 1890. At the fifth month the cervix appeared at the vulva. The labor lasted 15 hours and was normal. The proclitica decreased. The third pregnancy was in 1905. The proclitica increased until the fourth month. In the month of August she saw Sauvage and was admitted to the Rouleau clinic. The tumor extended 4 centimeters from the vulva and as 18 centimeters in circumference the intravaginal pedicle had a circumference of 14 centimeters and one could clearly perceive the hypertrophy and the supravaginal elongation. In the days following the tumor increased becoming very edematous (52 millimeters in diameter and 28 centimeters in circumference). The first pains appeared September 19. The membranes were felt 1 centimeter from the external orifice of the cervix. The labor was long and painful and it took 25 hours to secure full dilatation. Finally a fetus weighing 2,400 grams was delivered. A month after delivery the cervix extended about 1 centimeter beyond the vulva and the uterine cavity measured 11 centimeters with a bi-tometer.

The case of Ribemont Desaignes and Crase (10) was a para-gest 34 years who had one labor at term in 1900 with postpartum metritis. A little while later she noticed a hypertrophy elongation of the cervix which had no local treatment but increased very rapidly. She came pregnant again at the end of October 1903 the prolapse became correct and after the fourth month the cervix dilated to 10 centimeters. Later in May 1904 (5th month) there

was a sanguineous discharge. On May 13 the uterus was 24 centimeters above the pubes. By palpation supravaginal elongation was diagnosed. At noon on May 16 the patient lost amniotic fluid which presently became sanguineous. Uterine contractions began promptly but as the cervix showed no tendency to dilate by 10 p.m. cesarean section was performed. The puerperium was febrile with ultimate cure.

Balocchi (1) and Truzzi (15) admit that dystocia may occur. Fleischmann (6) sectioned the cervix in 3 cases in 1 case terminating labor with forceps and in 2 cases with cranial perforation. Boni (3) analyzing 16 cases pointed out 15 cases in which labor was terminated by operative procedures. Sauvage (13) in 17 collected cases noted only 1 spontaneous termination with every kind of intervention in the other 16 cases including manual dilatation incisions amputations for cephalopelvic disproportion and cesarean section (twice). Potocky in 1 case made two large lateral incisions in the cervix and performed craniotomy as practiced by Bouilly. The puerperium was febrile with ultimate cure.

But opposed to this gloomy series is another group of authors—Martin Howitz, Clivio Barnes, Scarlini, Fabre and Bourret (5)—who publish normal labors.

How can we explain these diverse views? Unfortunately in many of the observations published there exists great confusion in symptomatology. The authors do not differentiate sufficiently the cases of œdema from those of cervical hypertrophy and in these the intravaginal hypertrophy from the supravaginal. But when a differentiation is made we can distinguish two types of development.

Dystocia has almost always been demonstrated in the cases of supravaginal hypertrophy. It is well to stop and consider the mechanism of uterine accommodation to the fetus in order to understand to what extent the descent of the fetus is influenced by a long supravaginal segment only lightly elastic often presenting sclerotic lesions of chronic metritis. The inferior uterine segment cannot be physiologically enlarged and this explains the struggle against the cervical obstruction not only the dystocia but also the inefficacy of incisions in the vaginal portion only the extension of which is almost surely fatal.

Therefore in diagnosing cervical lesions of the hypertrophic type especially if associated with oedema care is the key to clinical success. In my judgment the problem resolves itself into one of expectation a prudent course in those cases of infravaginal hypertrophy and oedema. The question however becomes complicated when accidents accompany supravaginal hypertrophy.

Are we justified in operating during pregnancy? The old doctrine of *noli me tangere* in the gravid period now has few adherents. We have all performed operations for Bartholin's vaginal cysts appendicitis ovarian cysts necrotic myomata and have had no ill results but in every such case we have operated in the presence of specific indications. That is not the case in supravaginal hypertrophy. Dystocia always possible is neither necessary nor fatal. There is a period of clinical hesitation which coincides with the period of quiescence of symptoms.

In my opinion we are not justified in doing a prophylactic amputation except in the presence of acute infections as in my second case. Even in such cases when every precaution is exercised the operation may not stop the infection.

A large part of the success and applicability of the method rests in early diagnosis and watchfulness. There is no reason why we should not treat this type of cervical dystocia just as we do dystocia due to atresia and rigidity, the surest and quickest method is the best. Simple hysterectomy or subtotal hysterectomy according to the extent of the lesion and the degree of the infection of the uterine cavity gives the best results for both mother and child.

Because the lower route does not adequately remove the obstacle I am averse to it in principle as it involves trauma and lack of precision or is long drawn out. We have seen incisions fail and the Barnes bag fail and nothing urges one to methods of violence more quickly than the sensation of helplessness when confronted with resistance. This is true particularly with physicians who do not specialize.

Ample incisions of the cervix extending to the internal os and sufficient enlargement of

the inferior segment are excellent and efficacious measures. The mere recital of these conditions explains why they failed in the cases of supravaginal hypertrophy. I prophesy that in the future there will be a larger number of caesarean sections than in the past. This is not however the general consensus of opinion. Rapin Muggia Boni and Potocky (9) have done amputations during pregnancy. Nevertheless Engstrom and Hansson in 3 cases reported 2 interruptions of pregnancy.

Perhaps there is a solution. We will admit that expectant measures are best in cases of supravaginal hypertrophy. When operation is done an interruption of pregnancy can rarely be avoided and such procedures should be reserved for cases of infravaginal hypertrophy before pregnancy provided that it be done before the fourth month of gestation. Goodly doses of morphine are administered to insure uterine repose before and after operation.

May we say a word on prophylaxis? The possibility of dystocia in the presence of hypertrophic lesions of the cervix makes intervention imperative. Should there be present a prolapse in which the lesion is primary and is caused by disturbances other than pregnancy such as pelvic congestion uterine displacement and cervicitis amputation may be done.

But even so this imposes certain reservations. Our conception of the relation between the cervical amputation and the gravid period must be revised. In another article (16) I ventured to refute the arguments made by Professor Pinard against the operation of Schroeder. Today I am not so sure. I have seen miscarriages and cervical rigidity after well executed amputations. For several years we followed the case of a woman on whom a correct amputation had been done in Buenos Aires. In her case the cervix was so short that by the fourth month separation had occurred and the inferior support of the opening was made accessible through the internal os.

Three abortions and a premature birth have been the consequences to date of the operation. Therefore aside from pregnancy one must have this contingency in mind in amputating the cervix.

# CONCLUSIONS

1 Hypertrophy of the cervix may coexist with pregnancy and normal labor

2 Acute and chronic oedema which accompany hypertrophic lesions of the cervix during pregnancy may give rise to sudden accidents that may disturb the course of pregnancy and jeopardize parturition

3 Dystocia seems to be more frequent in cases of supravaginal hypertrophy

4 Except in cases of infravaginal hypertrophy diagnosed very early expectant treatment is preferable in the absence of complicating factors

5 Amputation of the supravaginal portion must not be advised during pregnancy. Amputation of the vaginal portion should not be made after the fourth month

6 In cases of dystocia provoked by hypertrophic lesions of the cervix with or without oedema the high route is preferable to the low

7 Simple oedema of the cervix almost always yields to rest and the Trendelenburg position. Only exceptionally is operation indicated

8 Septic conditions may constitute an urgent indication for cervical amputation during pregnancy

9 In performing cervical amputation when the patient is not pregnant one must bear in mind that excessive shortening like a cicatrization due to septic causes may interrupt pregnancy and cause cervical dystocia

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# CYSTIC INFLAMMATION OF THE VESICAL NICK AND OF THE PROSTATIC URETHRA

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**P**OSTERIOR urethritis of the specific or non specific type in the subacute stage very frequently reveals the presence of inflammatory cysts along the internal sphincter margin of the bladder. In fact this condition is so frequently seen cystoscopically that it is no longer of any particular interest. In addition to the inflammatory condition of the mucous membrane of the internal sphincter one usually sees a moderate or even a severe posterior urethritis. It is very unusual to find inflammation of the bladder mucosa accompanying this process which is in contradistinction to the condition known as cystitis and ureteritis cystica in which most of the lesions present are found in the bladder and in the ureter mucosa.

While in the former condition the cysts are inflammatory in nature in the latter they are degenerative resulting from a hydropic cellular change in congenital rests or island of epithelium (nests of von Brunn). The cysts are islands which originally constituted the apices of some of the papillae of the bladder or the ureter mucosa and which have accidentally become detached from their bases are situated in the submucosa. Epithelial rests such as these become encapsulated and may remain

dormant for variable periods. Changes within them are manifest when their innermost cells become hydropic their membranes rupture and their contents are discharged. Repetition of this process results in the destruction of more and more cells so that a section taken at this stage of development shows a cystic formation within which few motile bodies may be seen. Several investigators as a result of this observation have taken these bodies for protozoa and consequently have attributed the cause of cystitis cystica to a protozoan infection. The more accurate explanation of such bodies however is that they represent a few cells of the nest of von Brunn which have failed to undergo complete disintegration. The end stage of this process then presents cysts situated in the submucosa protruding into the lumen of the bladder or ureter and covered only by a thin atrophic layer of mucosa. Although the cysts in cystitis cystica may attain considerable size they are usually small and pearly gray when seen through the cystoscope (Fig. 1).

After careful observation of a large number of cases of gonorrhea and after performing cystoscopy upon them at least once in the course of the disease the author believes that infection of the prostate causes the cystic inflammation of the sphincter margin of the bladder and also of the prostatic urethra. It is a true contact inflammation which does not spread into the bladder or into the remainder of the urethra. Most of the cases yield to prostatic massage alternated with bladder irrigations with an antiseptic solution followed by thorough and vigorous stretching with the curved Kohlman dilator.

The following case is reported to demonstrate to what an extreme degree of cystic inflammatory changes both the sphincter margin and the prostatic urethra are subjected as a result of prostatitis.

CASE 1. V. C. 33, chauffeur consulted the author November 17, 1923, complaining of frequency



Fig. 1. Cystic changes in the bladder wall. The diagram shows a cross-section of the bladder wall with several small, rounded, cystic structures protruding from the inner lining (mucosa) into the bladder lumen. These are surrounded by a layer of tissue, likely the submucosa. The diagram is a schematic representation of the cystic changes described in the text.



Fig 1



Fig 2A



Fig 2B



Fig 3



Fig 4

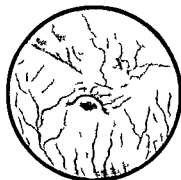


Fig 5

Case 1. Patient with a small cyst on the right wall of the urethra. The cyst was 1 mm in diameter. The patient had a history of gonorrhea 6 years ago but denied having had syphilis. General physical examination revealed a normal bladder and normal ureteral orifices. The cyst was easily catheterized and the specimens obtained from both kidneys were negative. Situated along the lateral margins and the roof of the internal sphincter were groups of cysts varying in size from millet seeds to good sized peas. The mucous membrane between the cysts was thick and velvety. Thick mucopus was seen issuing from the gap in

Fig 3. Case 2. Patient with a large cyst on the left wall of the prostatic urethra and also the small cysts in the floor of the urethra. The cyst was 1 mm in diameter. The patient had a history of gonorrhea 6 years ago but denied having had syphilis. General physical examination revealed a normal bladder and normal ureteral orifices. The cyst was easily catheterized and the specimens obtained from both kidneys were negative. Situated along the lateral margins and the roof of the internal sphincter were groups of cysts varying in size from millet seeds to good sized peas. The mucous membrane between the cysts was thick and velvety. Thick mucopus was seen issuing from the gap in

of urination every 30 minutes during the day and 4 to 5 times during the night. Pains in the back and legs, a feeling of pressure in the hypogastrium and a dragging pain in both groins. He had had an uncomplicated gonorrhea 6 years ago but denied having had syphilis. General physical examination was negative except for a distinct prostatic enlargement. Cystoscopic examination revealed a normal bladder and normal ureteral orifices. The cyst was easily catheterized and the specimens obtained from both kidneys were negative. Situated along the lateral margins and the roof of the internal sphincter were groups of cysts varying in size from millet seeds to good sized peas. The mucous membrane between the cysts was thick and velvety. Thick mucopus was seen issuing from the gap in

mouths of the prostatic ducts in the sulci between the verumontanum and the prostatic urethra. A well developed median bar constituted the floor of the internal sphincter and extending from this region to the external sphincter muscle over and alongside the verumontanum were rows of similar cysts looking like strings of pearls.

In view of the extensive nature of the lesion it was decided to institute fulguration in addition to the routine treatment as previously indicated. It was possible in this manner to destroy several of the cysts at each session. Cystoscopic examination made January 22, 1924, revealed the presence of a few large cysts on the roof over the right lateral margin of the sphincter and on the right wall of the prostatic urethra. The patient stated that the pain had dis-



Fig 6



Fig 7



Fig 8

Fig 6 Case 4 The urethra also the verumontanum showing a beginning cyst formation

Fig 7 Case 5 Cystoscopic examination showed the roof of the internal sphincter two small cysts which disappeared after treatment

Fig 8 Case 6 The urethra also the verumontanum showing a tumefied reaction to the right of the verumontanum. Arising from the urethra above the verumontanum. Also the cystic bodies on the lateral margin of the urethra. Also the cystic bodies on the lateral margin of the upper border of the verumontanum

appeared from his back and legs the feeling of fullness in the hypogastrium and the dragging sense in the groins had also vanished and he could hold his urine for 2 hours during the day voiding only twice during the night

Cystoscopy done April 1, 1924 showed two cysts on the right wall of the prostatic urethra and the gaping mouth of an occasional prostatic duct (Fig 2). The remainder of the prostatic urethra and the internal sphincter was normal. The prostate felt much better and the fluid expressed by massage contained only a few leucocytes. Except for an occasional shred both urines were clear. The patient's symptoms had entirely disappeared. Cystoscopy performed 2 months later showed the lesions depicted in Figure 2A and Figure 2B.

CASE 2 A T age 33, builder by occupation, father of three healthy children, presented himself for examination April 4, 1924. His chief complaints were increased frequency and painful urination—urinating every hour during the day and 3 to 4 times during the night. These symptoms dated back a year prior to which time he had never been sick except for frequent attacks of tonsillitis. Venereal disease was denied. Physical examination was practically negative except for a soft and boggy enlargement of the prostate to three or four times the normal size. The vesicles were enlarged and nodular and extended as far upward as the finger could reach. Prostatic massage fluid contained much pus and showed streptococcus hemolyticus and pneumococcus on culture. Urine passed into two glasses was turbid due to the presence of pus. The blood Wassermann was negative.

Cystoscopic examination showed a normal bladder and normal ureteral orifices. The latter were catheterized without difficulty and the specimens obtained were negative microscopically and culturally. Smear for tubercle bacilli were also negative and the phenol sulphonephthalein concentration from each kidney

was good. Upon withdrawing the cystoscope it was noted that the posterior urethra was filled with cystic polypi of various sizes, most numerous in the urethra above the verumontanum. Arising from the left lateral wall of the prostatic urethra and projecting half way across the upper part of the verumontanum was a large polyp portrayed in Figure 3. There was considerable enlargement of the verumontanum and the mucosa covering it was markedly edematous, red and velvety. The mucosa of the prostatic urethra was greatly engorged and velvety. Here and there in the sulci between the verumontanum and the urethra, mucopus could be clearly seen issuing from a gaping mouth of a prostatic duct.

Following the institution of prostatic massage and irrigations with protargol solution and fulguration of the polyp, the painful urination and nocturia disappeared, although the patient continued to void every 2 hours during the day. The urine still containing pus was much less turbid than formerly. Cystoscopy performed May 1, 1924 revealed a negative prostatic urethra except for an occasional small polyp. The prostate was smaller, less boggy and its secretion contained a moderate number of leucocytes to the high power field. The urine contained an occasional leucocyte and he was practically free from symptoms.

CASE 2 is reported with the view to showing how marked the polypoid changes of the prostatic urethra can become from a non gonorrheal prostatitis, even simulating a true neoplasm. It also illustrates how quickly relief can be obtained by a combination of fulguration and prostatic therapy.

CASE 3 M I Italian age 23 was seen April 16, 1923. He had had what was diagnosed as an acute anterior gonorrheal urethritis 3 months prior to this

time and after to weeks of intensive treatment was proclaimed cured. In view of his contemplated marriage he wished to know with certainty whether he was completely cured of the infection. He was free of all symptoms save a slight serous discharge in the mornings; past history was negative.

Cystoscopic examination revealed a negative bladder except for a small cystic nodule covered by a pinkish mucosa situated in the trigone a few millimeters below the center of the interureteric ridge (Fig. 4). Arising from the lateral wall of the urethra above the verumontanum were a number of large finger like cystic polypi. The mucosa between them was deeply injected and velvety. The verumontanum was enlarged but not cystic (Fig. 5).

This case demonstrates that marked cystic changes in the posterior urethra may be present without giving rise to symptoms. It also tends to show that in the course of prostatitis any subtrigonal prostatic tissue which may be present may be involved in the inflammatory process and give rise to submucosal cysts.

CASE 4. C. J. age 19 reported April 30, 1944, complaining of an occasional slight watery urethral discharge, slight burning on urination and a slowing of the urinary stream. He was treated for an acute specific urethritis 3 years previously and following the disappearance of the discharge was given prostatic massage for 3 weeks when he was pronounced cured. The remainder of his history was unimportant. Cystoscopically the bladder was normal but situated along the floor of the urethra above the verumontanum were a number of small grayish white flat plaques. Among these it was possible to discern an occasional pearly white cystic body (Fig. 6).

A diagnosis of cystic inflammation of the posterior urethra was made; the prostate was massaged found to be enlarged and boggy and to contain considerable pus. Following a few vigorous treatments of the prostate accompanied by thorough and thorough irrigations into the bladder the patient's symptoms subsided. At subsequent cystoscopy the urethra above the verumontanum was normal.

This case presents an example of beginning cystic inflammation of the posterior urethra together with definite symptoms of posterior urethritis.

CASE 5. M. P. age 25 complained of a morning drop and an occasional shred in his urine. Physical examination was negative except for an enlarged and nodular prostate containing a small amount of pus but no gonococci. Cystoscopic examination was negative except for two small cysts on the roof of the internal sphincter (Fig. 7) which disappeared after a few treatments.

This case demonstrates that careful inspection of the entire sphincteric margin must be made before a case of posterior urethritis is discharged cured.

CASE 6. J. C. age 29 an ironworker presented himself on June 6, 1924 complaining of a slight morning drop and of moderate pain in the perineum. He had had an uncomplicated gonorrhea 5 years ago and a chancre 1 year later. Up to date he has had 24 injections of salvarsan and 32 of mercury. A Wassermann taken 3 months ago was negative. General physical examination was essentially negative with the exception of a small hard prostate which on massage yielded a secretion containing a moderate amount of pus.

Cystoscopic examination revealed a normal bladder. Situated over the center and right lateral wall of the supramontane urethra were a number of tortuous pinkish white ridges which to the right were so clustered as to give the impression of a flat papillomatous tumor. Toward the center of the supramontane urethra however these tortuous ridges were discrete and short and on close study one could see that they were cystic in nature.

In the left wall of the urethra above the verumontanum a marked cupping was seen. The left side of the upper margin of the verumontanum presented a few small cystic bodies (Fig. 8).

A diagnosis of cystic inflammation of the posterior urethra due to prostatitis was made and the patient subjected to the usual therapy exclusive of fulguration. The symptoms soon disappeared and subsequent cystoscopy revealed a definite decrease in the lesions in the urethra above the verumontanum.

This case is presented with the view of demonstrating how bizarre the lesions in the posterior urethra can be with but a slight prostatitis constituting its underlying cause.

### CONCLUSIONS

1. Cysts and polypi around the internal vesical sphincter and in the prostatic urethra are frequently secondary to specific and non specific prostatitis.

2. Such cysts and polypi can attain very large dimensions and be mistaken for neoplasms.

3. The lesions in this condition differ from those in cystitis cystica in that they never invade the bladder and are of a purely inflammatory nature.

4. A combination of fulguration of the cysts and of local treatment for the prostatic condition will always yield excellent results in these cases.



JAUNDICE<sup>1</sup>

By JOHN B DE WILR, M.D., I.A.C.S., PHILADELPHIA

**J**AUNDICE may be defined as a condition in which bile is found in the blood stream and the urine and in which the tissues are bile stained. That part of the definition dealing with bile in the blood must be qualified since very small amounts of this substance in the blood are normal although the exact quantity is as yet unknown. When this amount is increased beyond a certain limit the tissues are stained and clinical jaundice ensues. When we ask the question however as to the threshold upon which staining of the tissues takes place we ask a question which cannot as yet be answered. Still another question awaiting solution concerns the quality of the bile and perhaps it is not only the quantity but also the quality which determines the jaundice. The color of the skin, sclera and mucous membranes in jaundice varies from light sulphur yellow to deep orange to green and dark olive. The latter two colors are found only in severe cases of long standing. Among other conditions jaundice is frequently attended by intense itching of the skin by bradycardia etc. Three problems have therefore already been brought to your attention early in this discussion of jaundice.

Jaundice is a symptom and not a disease. Since it occurs more often in surgical than in medical conditions and particularly because surgical jaundice is usually more amenable to treatment than medical jaundice I have upon a previous occasion been bold enough to say that more stress should be laid upon jaundice in surgical than in medical diseases. I have been led to make this statement by the fact that the pathology found at operation in patients with jaundice rarely if ever can be removed by other than surgical means therefore I take this opportunity to make the surgical significance of jaundice the pith of my discussion.

Jaundice is not always the result of liver pathology alone but is often interrelated with disease of the spleen the reticulo endothelial system and the hæmatopoietic system.

For purposes of convenience jaundice may be classified in a number of different ways but I have always found the simplest and one of the most practical to be that which divides it into the painful and the painless types for practically all cases of jaundice are either preceded by pain or have no pain at all. For example the jaundice following obstruction of the ducts by stone is preceded by pain with the exception of the rare silent stone which is occasionally seen. The jaundice caused by carcinoma of the head of the pancreas in my experience not generally preceded by pain but pain we must remember is a very relative thing depending very often on the temperament of the individual sufferer. The correct interpretation therefore of the patient's statement that he has pain is very important as for example the discomfort caused by accumulations of gas in the stomach and the intestines may be real pain to some and mere discomfort to others. It is not however the type of pain requiring morphine for relief and this question is a most important distinction in correctly interpreting a patient's statements. It is a fact that the cause of painful jaundice is more easily determined than the cause of painless jaundice and furthermore since the painful type is more amenable to permanent cure than painless jaundice and ordinarily is not so serious to the patient's future this symptom of pain becomes all the more important. It is possible to arrange the causes of jaundice in the order of frequency of their occurrence although such tables are often hazardous and depend considerably on the character of the hospital service the location the racial type of patients ages etc. In my experience the following would be the sequence: calculous and non calculous cholecystitis with cholangitis, cholangitis chronic and acute pancreatitis, gastroduodenal catarrh, carcinoma of the head of the pancreas. Following this we find in varying order the following conditions: Banti's disease, hæmolytic icterus, carcinoma

of the bile ducts and papilla of Vater biliary cirrhosis purpura hæmorrhagica diverticulum of the common duct nervous shock acute hæmolytic ulcer of the second portion of the duodenum pyelophlebitis infections elsewhere than in the upper abdomen aneurysm of the hepatic artery contracted papilla of Vater injury of the bile ducts infection following operation upon the biliary passages secondary tumors of the liver and so on. The most common type of jaundice is that of gall bladder disease which in our terminology means primary infection of the liver and of the large and small bile passages.

The usual form taken by gall bladder disease is a cholecystitis of which there are two varieties the acute and the chronic in either of which gall stones may be present and in either of them jaundice is comparatively rare when present it is due usually to infection of the liver with cholangitis or secondly to lymphatic infection from the gall bladder to the liver and a cholangitis or infection through the cystic duct into the hepatic ducts and thus also a cholangitis. The pathologico-anatomical findings in cholangitis are periductal infiltrates diminution in the size of the lumina of the ducts with the pathologico-physiologic results of obstruction to the outflow of bile retention and entrance of bile into the blood stream and all the phenomena of jaundice. It matters little what is the cause of cholangitis jaundice is the result.

With this in mind it need no emphasis therefore that gall bladder disease with jaundice is a more formidable condition than gall bladder disease alone. There have been a number of possible routes indicated by which the gall bladder may become infected and in the past it has often been the style to assume that the gall bladder is infected via the blood stream at another time via the lymphatics and so on with changes every few years in the mode of thought. It appears to me much more likely however that the gall bladder is not infected in any one way or another but all routes are possible and that there is no one general route. It is very likely that individuals will have gall bladders infected in their own individual ways al-

though it may be impossible to determine the individual routes. The importance of this conception can be brought out by rehearsing experiences such as these when the infection in the liver is brought by way of the blood stream it means that the hepatic cell are the first to be damaged therefore the jaundice following this course of events has a more serious aspect. The jaundice occurring a short time after an operation upon the biliary passages in a patient not previously jaundiced points either to injury to the bile ducts themselves or to the spread of infection into the lymph system the result of operative manipulation. I have seen this occur following an unrecognized injury to the hepatic or common ducts the infection found at operation was doubtless spread by the operation itself. This can be compared to the extension of carcinoma through the lymphatics such as takes place in breast cancer (Handley). It follows therefore that operation upon the gall bladder must be done with the same care as removal of the breast. Dissection should work in the opposite direction to the lymph current the gall bladder should be removed from below upward and not from above downward. I believe it is better to examine the common bile duct from within than to finger it too much from without in searching for an obstruction. Finger dissection in cleaning the axilla in a breast operation is not so good as a knife and forceps dissection. Massage is not a part of good operative technique it may have a place after but not during the operation.

Gall stone disease of the common bile duct with stone is always accompanied by a jaundice which as is well known and as I have stated is preceded by severe pain in practically all instances. There may be exceptions to this but they are rare.

Only recently I have had an example of this in a male patient aged 77 years who for one year had been gradually failing having lost 60 pounds in weight with loss of appetite a sallow complexion in fact all the indications of a slight jaundice.

When he first consulted me I was not able to determine anything by physical examination except a large liver the surface of which presented irregular

in an ten l r n ss to pr ssure. He was sent to the hospital for study and operation. The various tests were negative with the exception of the urine and faces the former showing some bile and the faces a very small amount of bile. The blood picture was that of a conary anemia leucocytes 12 000.

He had never suffered severe pain which explains his not having consulted a surgeon. His physicians were two very excellent internists one of whom held a title in him throughout the entire illness. Finally he was thought to have organic disease and was taken to undergo an exploratory operation. My interne who carefully examined the patient after eliciting a full history thought he had malignancy. I entered the diagnosis of common duct obstruction after the patient told me that for some weeks he had been taking his own temperature having been led to do so on account of occasionally having a light chilly feeling in the evening following which his temperature rose to 99-99.5 degrees. I asked if he had any pain before he felt chill, he said no but did say that he had some discomfort in the upper left lumen to which he did not attach much if any importance. I then asked him if he thought his urine was a little more highly colored on the next day and whether the stool was lighter in color than usual. He answered yes and commented on this to some extent when I readily saw these two conditions he impressed him coincidentally. While he did not think he was jaundiced he did say the whites of his eyes were a little yell when the lay following the chilly feeling of the previous evening. Upon these statements I told my house doctor I thought this was a case of mill stone in the common duct and further if I were correct the enlarged liver would be a curiously biliary cirrhosis. I operated for six days after his admission. Findings: A greatly enlarged embossed and comparatively hard liver of an asque color and some enlargement of the pleural enlarged glands along the common duct the most of the chain being the size of an English walnut the head of the pancreas enlarged but not hard the gall bladder about half the normal size the walls thickened and shrunken but containing no stones. The cystic duct which was long and narrow parallel with the common duct joining it below the first portion of the duodenum contained a small stone as large as the first portion of the common duct. The most difficult part of the operation was the finding of adhesion about the gall bladder the hepatic flexure of the colon and the diaphragm in extending the gall bladder and the ducts. These adhesions were well organized and could not be displaced by using knife and scissors. I opened both the cystic and common ducts extracted the stones and drained both into the cystic with a straight rubber tube and the common duct with a rubber tube. The gall bladder and the appendix the latter much thickened and enlarged was removed. The tube in the cystic duct was removed in 10 days and a straight rubber tube which had been dropped into the subhepatic space was taken

out on the fifth day. The recovery was uneventful but slow. The tube was removed 5 weeks after operation. Now 10 weeks after the operation the patient is gaining rapidly having put on 23 pounds his appetite he says is hard to satisfy and his skin is clear. The liver is now normal in size to percussion and palpation. This case as I have said was never the subject of an hepatic colic but showed a mild form of pain.

An unusual and yet not so uncommon diagnostic complexity is afforded by subacute inflammation of the head of the pancreas. The differential diagnosis between it and calculous obstruction of the common duct is oftentimes impossible. I have operated in a number of cases in which the diagnosis of calculous obstruction has been made by able clinicians to find at operation pancreatitis of the head of the pancreas with no obstruction from within the common duct.

Non calculous cholecystitis presents a syndrome practically like that of the two former conditions with the exception of the absence of pain and the more pronounced chills and sweats. One such patient remarked he perspired enough to saturate his night gowns every night. This patient never had pain except before the first operation. She had been under my care twice before the first operation was cholecystectomy for calculous cholecystitis the second operation drainage of the common duct by a straight rubber tube for cholangitis the third operation was T tube drainage of the common duct for recurrence of cholangitis at which time she remarked that she would not allow me to remove the T tube for a long time saying she did not want another recurrence. This patient wore the tube for many months he has remained well.

When jaundice appears in acute pancreatitis it is the result of blood stream infection with damage to the hepatic cells the excretion of infected bile causing cholangitis.

Since the jaundice in subacute and chronic pancreatitis is due to pressure upon the terminal common duct by the head of the pancreas it can be corrected only by surgical measures.

A fairly common condition that known as catarrhal jaundice which is the result of a gastroduodenal infection which reaches the

liver by way of the common and hepatic ducts. Were this always the mild infection it is said to be there would be less to worry us when confronted with this condition but the pancreas is quite frequently involved by way of the pancreatic ducts so that there is mild inflammation of the entire organ. Where only the head of the pancreas is attacked the infection has come by way of the lymphatics of the liver the bile ducts and the peri pancreatic lymph nodes. I have operated upon many cases of chronic catarrhal jaundice following an acute stage in which the pathology exposed was as I have described. It is therefore far from wise to allow cases of chronic catarrhal jaundice to drag along because the consequences in the shape of biliary and pancreatic cirrhosis are so close at hand both of which conditions are amenable to a large extent to surgery but not to medical treatment. When the pathology of the liver the bile ducts and the pancreas is well advanced the operation is serious and the symptoms too often recur. When insufficiency of the liver and pancreas is once established the favorable period for surgical interference has passed. The jaundice of Banti's disease hæmolytic jaundice purpura hæmorrhagica splenic anæmia and related conditions can be corrected only by removal of the spleen. In these cases also it is the delay and not the operation which influences the seriousness of the situation.

The jaundice of carcinoma of the head of the pancreas and of the bile ducts can be relieved only by one or another of the anastomotic operations. The exception in bile duct carcinoma is the case in which the neoplasm can be removed with restoration of the lumen of the duct a possibility which needless to say is very rare.

The jaundice of choledochitis diverticulum of the common duct and biliary cirrhosis can be relieved only by operation. Jaundice caused by aneurysm of the hepatic artery by pressure upon the ducts from without or traction by adhesions of the bile ducts takes a purely mechanical means to correct it. As a rule these are not favorable cases yet a cure is occasionally obtained. In syphilitic condition the prognosis is more favorable. The

jaundice in pyelophlebitis is hopeless from every standpoint. Were it possible to recognize the condition early enough incision and removal of an infected thrombus of the portal vein might be possible. I have had occasion successfully to repair the injured portal vein with suture so that direct attack for removal of a thrombus is among the surgical possibilities. The most common cause of this fatal condition is appendicitis and thrombosis of the appendiceal veins therefore in the cases of gangrenous appendicitis with gangrene of the meso appendix the cæcum should be dislocated forward and inward and the veins in the immediate neighborhood inspected when if found thrombotic they should be tied off distal to the thrombus or thrombi. I never operate especially in the presence of a gangrenous meso appendix that I do not bear this in mind as well as have a pyelophlebitis staring me in the face.

I occasionally see jaundice with duodenal ulcer where the exudate of the ulcer involves the wall of the duodenum adjacent to the terminal (interstitial) portion of the common duct and when in addition to the ulcer there is a cholecystitis. I have met with these associated conditions a number of times. This jaundice is most likely the result of both compression by the exudate and also to cholangitis due to lymph borne infection from the ulcer bearing area. By the same principle reversed duodenal ulcer can be caused by infection carried from the liver the gall bladder and the bile passages.

Infection elsewhere in the abdomen than in the upper right quadrant is also occasionally accompanied by jaundice due in all likelihood to infection via the blood or lymphatic streams. Unfortunately this is too often a serious omen with an unfavorable outcome.

I could mention a number of other operable conditions in which I have very occasionally seen jaundice such as solitary abscess of the liver echinococcus cyst of the liver tumor of the right kidney movable right kidney and tumor of the hepatic flexure. It is interesting for us as surgeons to take note of the many other conditions in which jaundice may be present irremediable to surgery and very

often to medicine. Among these are acute yellow atrophy of the liver poisoning by arsine phosphorus and so on. Weil's disease, icterus neonatorum, enlarged lymph nodes due to Hodgkin's disease, tuberculosis, leukaemia etc. gummata of the liver, eclampsia, infectious diseases such as pneumonia, typhoid fever, influenza, malaria, yellow fever, relapsing fever, secondary syphilis and so on. The comparative rarity of these conditions as causes of jaundice bears out my contention that the more common types are surgical and not medical conditions except as diagnostic problems. Am I not therefore correct in asking that jaundice be emphasized more in the surgical vocabularies than in the medical and am I not correct in emphasizing and re-emphasizing that among these conditions which are remediable by surgery, all of them are fraught with serious consequences? The surgeon cannot be called too early but he can be called too late.

The jaundice occurring after operation on the bile passage is due to one or other of two things: infection prevalent at the time of operation when the jaundice will appear a few days after the operation or injury to the bile ducts when the jaundice appears almost immediately. In either event the jaundice is pruritic. The jaundice of infection clears up in a comparatively short time whereas the jaundice due to an injured duct is permanent and increases in intensity thus simulating that due to obstruction by malignancy. The jaundice due to injury of the bile ducts is remediable only by operation. This alone makes the responsibility in the operations all the greater and makes imperative a comprehensive working knowledge of the topographical anatomy of the operative field. The only way surely to avoid injuring the common duct or the common hepatic duct is to expose them to the eye at the point where the cystic duct joins them before clamping, tying or cutting the cystic duct. It is also necessary to expose separately the cystic artery before passing the ligature or placing a hæmostatic forceps. This is easily done by incising the free border of the gastrohepatic omentum and carefully reflecting both leaflets. When a duct or ducts are injured accidentally

the condition should be recognized and repair made at once otherwise a second operation usually very formidable will be necessary. Repair when injury is recognized at the time of occurrence can usually be made by suture alone or suture and drainage with a rubber T tube. When the right branch of the hepatic duct has been cut across it is usually sufficient to introduce and retain for several days a straight rubber tube. When a second operation is necessary and the ends of the duct (hepatic or common) cannot be identified and therefore cannot be apposed and sutured with or without a drainage tube, an anastomosis will be required between the proximal end of the duct and the duodenum. When these operations are done it is understood of course that the gall bladder has been removed. When the common or hepatic duct is obstructed by stricture, idiopathic or traumatic, most likely the latter, incision of the duct proximal to and dilatation of the stricture if it does not involve the entire circumference of the duct and drainage suffices. When however the stricture involves the entire circumference of the duct, resection and end-to-end suture usually offers most for a permanent cure.

The preparation of the jaundiced patient for operation will include the careful study of all the organs from a physiological and pathological standpoint which includes the chemistry of the blood, the coagulation time, the blood pressure, the heart, the kidney function and the liver function. Study of the latter is of most moment when done in connection with the former studies. These patients as a rule are better prepared for operation if given glucose and in some instances insulin alone or with glucose for 3 or 4 days before operation.

In patients whose urine contains acetone or diacetic acid I hesitate to operate until the urine is free of these. Acidosis occurring after operation may be formidable and calls for prompt and heroic treatment. After the operation the aforementioned point must be kept in mind and treatment directed accordingly if the patient is to be carried through a safe convalescence.

In all my operations for gall stone disease I drain the subhepatic space. Morrison's pouch

or the renal well. I have never seen bile peritonitis where drainage has been used with but two exceptions. These followed several days after operation when drainage had been used and happily both patients recovered, one by spontaneous drainage of the collection of bile through the operative wound and the second after abdominal incision and pelvic drainage. I have seen in consultation pa-

tient with bile peritonitis not recognized and not operated upon in whom drainage was not used all of these patients died. Bleeding into the peritoneum in badly jaundiced patients occasionally occurs but is less likely since blood transfusion and intravenous injection of chloride of calcium solution has been practised. The best time to guard against this is before operation.

## ILIUS AMORPHUS

## REPORT OF A CASE.

By J. I. SIMONDS, M.D., and C. W. A. COWLEN, M.D., CHICAGO  
1 month. Lys. tm. t. f. P. h. i. g. N. h. L. ty. M. d. i. hool.

**F**ETUS amorphus is one of the rarer types of monstrosities. A case of this malformation recently studied by us led to an extensive survey of the literature. Our case has proved to be one of the most uncommon forms of this rare type in that only the head end of the fetus developed. Not more than 6 cases of this form have been reported in the literature. It was found further that the cases of this type of monstrosity have not been collected and analyzed in English since Ballantynes report in 1894. His paper was published 30 years ago in a journal that is now long since extinct and the files of which are not readily accessible. It has appeared to us therefore that a full review of the literature at this time might be of value. We have collected from the literature 45 cases of fetus amorphus in man and 16 cases in lower animal. To this group we have added other case that seem to represent transition forms between fetus amorphus and molar

A brief summary of the collected cases follows.

1. Benedetti (1) in 1533 mentions a *lefe* of *lefeus amorphus* but gives few details. He thought that the mass was a hyaline mole. This specimen contained no crystals.

2. Vail neri (2) in 1 33 de rib da f tu a or  
 1hu which w s born with a mole and not as  
 usual with a normal t in The specimen cont ined  
 bones into t e lung liver pancre s n l heart(?)

3 Bland (3) The specimen was 20 centimeters in length weighed 900 grams had hair rudimentary skull 8 vertebrae brain and spinal cord

4. *Iheronax* (4) The specimen was kidney shaped 2.3 by 1.1 inches and had four. There was a small protuberance on the surface which contained a bone. Rudimentary skull vertebra ribs pelvis and some bones of upper limb.

5. Class (5) The specimen was globose in shape. The original article was not accessible.

6. Gluge and D Udekem (6). The specimen was reniform 10 centimeters in length and had hair. The only internal structures mentioned were in the heart (?) and a glandular organ probably the liver.

Cornul and Cau it (7) An egg shape 1 mass 5 by 4 5 centimeters with hair showed traces of rt bræ and another bony mass either a lower jaw or clæcl rudimentary brain traces of nerve and skeletal muscle

8. Color (8) A trilobate mass 7.5 by 6.4 cm in size with hair containing vertebrae rudimentary brown (?) and striated muscle.

centimeters, weighed 170 grams. There was hair on the sacrum and coccyx were the only bones mentioned. There was no brain nor spinal cord. There were present partially degenerated skeletal muscle fibers, loop of intestine and a glandular organ probably the liver.

o Kleinwachter (10) The specimen was an egg shape mass 16 by 11.3 centimeters with hair  
In original article as not accessible

11. Freudenberg (11) The monitosity one of triplets as egg shaped and weighed 1900 grams. Hair was not mentioned. The mass was attached directly to the pascents and except for the area of attachment was covered with skin. Sternum and clavicles were the only bone mentioned as being

present A rudimentary br in anl glanl v re found

12 Iruss (12) The ms was 34 centimeters in length The original article was not available

13 Kron r and Schurhardt (13) The skin shaped ms was 20 by 12 by 5 centimeters weight 1220 grams showed rudimentary v ribbrae anl femur intestine skel anl nucle anl glanl epithelium

14 Noeggath (14) A mass 10 by 40 centimeters present no bone but striated muscle

15 Lehmann (15) The ms was kidney shaped 15 by 9.5 centimeters weight 1000 grams and presented hair Base of the skull several vertebrae sacrum one iliac bone rudimentary brain intestine kidneys periton anl cavity a rudimentary urinary bladder and a lung (?)

16 Augebauer (16) The mass egg shaped 12 by 12 with hair a pelvis rudimentary lumbar vertebrae trace of a pinal corl a heart (?) anl a penis like appendage

17 Crut (17) A glular mass 8 by 4 centimeters weight 5 grams It presented skull bone 15 vertebrae ribs pelvis anl brain substance

18 Bollt (18) An egg shaped mass 9.5 by 7.5 centimeters had hair and one bone which resembled a phalanx of a finger There were no viscera

19 Hermann d Bluet (19) An egg shaped mass 6 by 4.5 centimeters showed hair and trace of spinal corl anl vertebrae

20 Iller (20) A mass shaped like a mallet 6.5 by 3 centimeters presented on bone like the head of a femur hair intestine glular organ like a liver and a rudimentary heart (?)

21 Iller (21) An egg shaped mass 10 by 8 centimeters with hair weight 260 grams It was a confused mass of bone anl cartilage intestine anl striated muscle

22 Hest (22) This was an oval mass No further details were given

23 Schuller (23) A mass 22 by 15 centimeters weight 2030 gram There were present a skull vertebrae anl a rudimentary pelvis

24 Welter (24) A pear shaped mass 16.5 by 11.5 by 6 centimeters presented hair rudimentary vertebrae anl possibly bones of an upper limb rib anl a question of rudiment of human kidney

25 Muck (25) The original article was not accessible This was a true amorphous

26 Krautwig (26) This was fetus amorphous with internal genitalia No other details were given the report

27 Chilton (27) A mass 19.5 by 14 by 5.5 centimeters weighing 740 grams presented the small part of the base of a skull 12 vertebrae ribs a pelvis containing the racic and periton anl cavity and no viscera anl an avulsed as made

28 Kinoshita (28) This was one of triplets No other details were available

29 Dienst (29) This mass was triangular in shape with lanugo hair No details to internal structures were given

30 Welter (30) The mass 4.5 by 2.5 centimeters as oval anl had hair It was one irregular mass of bone possibly the base of the skull

31 Guénol (31) It was a flattened ovoid in shape and had hair No bones anl no cavities were mentioned Skeletal muscle (?) was present

32 Hunziker (32) The mass was 11.75 by 8.5 by 5.5 centimeters and weighed 300 grams It contained base of skull vertebrae ribs pelvis bone 1 brain kidney skeletal muscle lymph glands and nerves An X ray plate was made

33 Schvalbe (33) The mass 14 centimeters long presented the base of a skull vertebrae lower jaw femur rudiment of brain anl skeletal muscle An X ray plate was made

34 Meyer (34) This specimen contained a neuromusculature a nervous stem a pleuropentoneal cavity a urogenital tract anl lymph glands

35 Kalmvko and Obrastov (35) A mass the size of a fist accompanied a twin showing hypospadias The original article was not accessible

36 Birnbaum (36) There was a picture of a fetus amorphous but not suitable to structure the text

37 Mueller (37) The mass 11.5 by 10 centimeters contained the base of a skull vertebrae ribs anl scapula brain spinal cord anl an anlage of intestine

38 (a rigues (38) The mass 8 by 7 by 5 centimeters as the upper part of a skeleton with a fluid filled cavity

39 Gruenbaum (39) The specimen was the size of a billiard ball No bone was mentioned There was small mass of striated muscle

40 Rissel (40) A kidney shaped mass 14.5 by 11.5 by 5 centimeters presented hair base of skull vertebrae humerus girdle rudimentary brain anl pinal corl small bits of cartilage surrounded by skeletal muscle intestine anlage of respiratory tract anl heart muscle (?) An X ray plate was shown

41 Stewart (41) The mass was shaped like the trunk without a head or limbs measured 14 by 9.5 by 7.5 centimeters and contained base of skull 12 vertebrae ribs pelvis no body cavities liver intestine kidneys testes ureters a lymph gland anl a penis present An X ray plate was shown

42 Dugal (42) A mass 3.5 by 1.5 inches with hair presented a skull vertebrae rib shoulder girdle pelvis bones brain anl spinal cord A heart as it had been present The twin as a cephalic monster

43 Helman and Abbott (43) The fetus on of triplet was haplo like an enormously gnarled limb human 12 by 8 by 8 centimeters (after hardened) There were present hair a jaw with 7 teeth and probably part of the base of the skull a mouth a tongue anl eye clefts An X ray plate was shown

44 Slemon (44) The specimen kidney shaped 6 by 4 by 2 centimeters as attached to the placenta by a pedicle The surface of the mass was not

covered with skin. There was a small bone with epiphyseal cartilage but no rudiments of any organs.

45 Lok (44) No bone was mentioned. There was a rudiment of intestine, a testicle, kidney, and a renal striated muscle and lymph glands.

The following cases of fetus amorphus have been reported in lower animals:

### I IN CATTLE

1 Ruysch (45) The original article was not accessible.

2 Curll (46) described 2 cases. The one was somewhat asymmetrical, amorphous masses largely covered with hair. Cartilage and bone were present but too irregularly formed to permit identification. Only fat connective tissue and blood vessels were evident.

3 Blau & Sutton (47) This specimen showed no bones on X-ray examination and was largely covered with hair. No further detail was given.

4 Anthony and Salmon (48) No detail as to shape, size or internal structure were given. The specimen showed an eye with a crystalline lens.

5 Schmincke (49) This was an egg-shaped mass 16 by 7 centimeters with lower jaw and teeth, scapula, humerus and intestine. An X-ray plate was shown.

6 Schmincke (49) A triangular-shaped mass 11 by 11 centimeters, the dorsal surface of which was covered with hair, presented a rudimentary tibia and fibula, humerus, pelvis, anlage of mouth, upper lip and tongue and intestine. X-ray plates were shown.

7 Schmincke (49) A spherical mass 11 centimeters in diameter was partially covered with hair. The lower jaw was only bone. A penis anlage was present.

8 Schmincke (49) An egg-shaped mass 15.1 by 1 centimeters was hairy on one side. It presented an anlage of the pelvis and a bony mass that could not be identified, possibly a lower jaw. An X-ray plate was made.

9 Schmincke (49) A disc-shaped mass 9 by 3.4 centimeters presented one small hemp-seed sized bony mass. An X-ray plate was made.

10 Schmincke (49) An elliptical-shaped mass 18 by 10 by 5 centimeters contained one bony mass the size of a pea and the size of a cherry. An X-ray plate was given.

11 Schmincke (49) A spherical mass 18 centimeters in diameter partly covered with hair contained two unidentified bony masses. An X-ray plate was shown.

12 Schmincke (49) A long oval mass 10 by 4 centimeters covered with hair presented an unidentified cherry-sized bony mass. An X-ray plate was shown.

### II IN A GOAT AND SHEEP

1 Schmincke (49) A long rounded mass 0 by 8.5 by 1.8 centimeters covered with hair had two

small projections possibly representing anlage of limb, a scrotum, probable anlage of pelvis, sacrum and one lumbar vertebra. An X-ray plate was shown.

2 Schmincke (49) A flattened egg-shaped mass 8 by 3 centimeters covered with hair presented two very small unidentified bony masses. An X-ray plate was shown.

3 Doran (50) mentions a fetus amorphus of a sheep in the museum of the University of Edinburgh.

### III IN A BIRD

1 Tur (51) described very briefly an amorphus embryo of a rook (*corbeau freux*).

These 61 cases in man and lower animals are distinctly instances of fetus amorphus. In the following 11 cases there were anlagen of one or more limbs, which fact excludes them from the group of true fetus amorphus. But these anlagen were so rudimentary that the specimens could not be classified as distinct mylacephalus. These cases therefore appear to represent a borderline group between amorphus and mylacephalus.

1 Vrolik (52) The mass was egg-shaped with rudimentary lower extremity, hair, vertebrae, ribs and pelvis, rudimentary brain and spinal cord, striated muscle, nerves, intestine, rudimentary urinary bladder, rudimentary gland and possibly a liver.

2 Barkow (53) A mass 10 centimeters in length presented a rudimentary left upper extremity, vertebrae, ribs, cartilaginous suggestions of bones of extremities, mouth, rudimentary eyes and nose and gland structure, probably liver.

3 Sriedt (54) A cake-shaped mass 16.3 by 11.3 centimeters had a small projection on the rump thought to be a rudimentary lower limb, vertebrae, ribs and femur, lower jaw, skeletal muscle, intestine and a rudimentary kidney.

4 Sangalli (55) A mass shaped like the grub of a moth, 30 centimeters in length, presented hair, three small projections (one with a rudimentary nail), base of skull, vertebrae, ribs, pelvis, femur, tibia and fibula, rudimentary brain, skeletal muscle and intestine.

5 Ianum (56) A mass 7.5 by 5.3 by 3 centimeters presented a skull, vertebrae, ribs, clavicles, pelvis and rudiment of right arm.

6 Hirschbruch (57) An egg-shaped mass measured 11 by 9 by 6.8 centimeters. One area 2 by 8 centimeters was covered with cylindrical epithelium elsewhere it was covered with normal skin. There was a small projection, possibly a rudimentary limb, and fine lanugo hair on one end. There was a nodular egg-shaped bony mass with a ring-shaped mass on its upper end. Small endothelium lined cysts were in the skin. No muscle, nerves or organs were found.



7 Meyer (34) A mass 6 by 5 by 3.5 centimeters presented two very rudimentary lower limbs and external genital femur pelvis houl r girdle and irregularly formed vertebral haur brain tract of pinal cord intestine rudimentary resphagus trachea kidneys urinary bladder prostate gland rudimentary liver and pancreas and lymph glands

8 Commendant Jarricot (58) A hilob of mass weighing 6720 grams and measuring 22 by 14 centimeters presented lumbar vertebral pelvis and bones of foot

9 Sitz nfr (59) This specimen showed a rudimentary lower limb vertebral ribs rudimentary lobe of skull pelvis and bones of leg An X ray plate was given

10 Hyl (60) A mass weighing 60 gram measuring 9 by 8 by 3.5 centimeter presented a rudimentary anal of a lower limb with sole of foot rudimentary jaw and teeth and lip intestine respiratory tract adrenal kidney ovaries brain and pinal cord

11 Kiesel (39) A mass elongated round in shape 13 by 8.5 by 5 centimeters weighing 360 grams presented hair suggestions of upper and lower limb rudimentary skull femur tibia fibula metatarsal bones and phalanges and part of pelvic girdle No vertebral were mentioned and no organs found An X ray plate was shown

To the above group of cases collected from the literature we add the following case studied by us

This specimen was extruded from the uterus of a young primipara about 15 minutes after she had given birth to a normal male infant weighing 7 pound 5 ounce and measuring 50 centimeters in length There was only one placenta which unfortunately was destroyed before there was an opportunity to make a study of it

This fetus amorphous was an ovoid mass measuring 14 by 10 by 9 centimeters and weighing 835 grams The upper pole was rounded and covered with dark brown hair about centimeters in length The lower pole ended in a blunt point The umbilical cord was attached 1 centimeter below the navel point of the anterior surface The entire surface of the mass was covered with skin except for a horizontal depression 3.5 centimeters laterally and 6 to 9 millimeters perpendicularly located on the left half of the anterior surface 0.5 centimeter above the place of attachment of the cord The right lateral surface of the mass was rounded the left somewhat flattened

The horizontal depression mentioned above had a rounded upper margin and a somewhat angular lower edge It was approximately 1 centimeter in its greatest depth The rim ended about 1 to 2 millimeters from its margins The lining of the depression was red in color and granular in appearance Its wall varied in thickness In the bottom of the depression this measured from 3 to 4 millimeters in thickness and separated the depression from one of the cavities inside the mass On the left lateral half of its upper margin there was a old rounded projection 6 millimeters in diameter On incising this mass after hardening it in formalin we found that it contained a hard oval mass having the shape and general appearance of a crystalline lens Microscopic examination disclosed in the posterior part a structure resembling retina This mass therefore represents a rudimentary eye

On the anterior part of the upper half of the specimen there were three cyst like bulgings varying from 6 to 18 millimeters in diameter We opened the mass and the bulbous were found to occupy the location at which smooth walled fluid filled cavities lay immediately beneath the skin

X ray pictures of the mass showed it to contain bony structures which appeared to be a rudimentary base of the skull and three vertebral The lowermost of the vertebral ended in a knob like projection

Sections of the mass showed it to be composed chiefly of pearly gray very edematous connective tissue with a considerable amount of fat in the lower third of the mass Three separate cavities are present The largest cavity 1 of irregular shape measured about 8 by 5 by 4.5 centimeters in its greatest diameters and is composed of several smaller communicating cavities It lies chiefly above the bony structure that appears to represent the base of the skull and probably represent the cranial cavity One of the smaller communicating cavities extends downward into the upper end of the vertebral and the rudimentary spinal canal The walls of this irregular cavity are composed of a dense membrane firmly attached to bone where the present and its inner surface is smooth and glistening except at its lowermost part that



Fig. 1. The graph shows the light and dark surfaces of the fetal amorphous. The large of the fetal mass is at the rudimentary spinal canal.

is in the depth of the rudimentary spinal canal. Here the lining is lusterless, soft and measures 2 to 3 millimeters in thickness. Sections from this soft portion are found to be made up of glia cells among which are a very few ganglion cells. This is the only part of the cavity that shows anything resembling central nervous system. Anteriorly and above this irregular cavity approaches the surface very closely in several places so that its lining is practically in contact with the skin. The places are the sites of the cyst-like bulgings described above.

Anterior to the rudimentary base of the skull is a smaller cavity measuring by 3 centimeter with a smooth lining, beneath which are several large branching blood vessels. Immediately below the lining membrane of the lower part of this cavity is a mass of fat.

Below and behind the lower end of the rudimentary vertebra is a third small cavity by 1.5 centimeter with a lining that is



Fig. 2. The photograph shows the rudimentary base of the skull. The (refur) is the rudimentary base of the skull.

rather lusterless and thrown into low folds. It has not been possible accurately to identify either of these smaller cavities.

On microscopic examination we can make out no organs except the eye and the very small mass of brain or spinal cord mentioned above. Sections from the anterior part of the mass show an area in which there are a few scattered fibers of striated muscle. Otherwise the sections contained only edematous connective tissue, fat and blood vessel. In the skin of the upper pole there are hair follicles and sebaceous and sweat glands.

In this specimen therefore all of the recognizable structures were rudimentary. They consisted of a mouth, eye, base of the skull, vertebra, and either brain or spinal cord. Hair, hair follicles, sebaceous and sweat glands, a few fibers of striated muscle, blood vessel, fat and connective tissue make up the structures found in this specimen.

Including our own specimen we have 46 cases of fetus amorphus in man and 16 in



tained rudiments of other highly differentiated organs would suggest that bone also had been formed but for some reason was not noted in the record of the case. Of individual bones vertebrae and one or more bones of the base of the skull were most commonly found. In no case was the skull complete. Brain and spinal cord always as very rudimentary structures were stated to be present in 19 cases. It is interesting to note that the most highly differentiated tissue in the body namely the central nervous system is so common a finding in this type of monster. Next to rudimentary brain and spinal cord in frequency was striated muscle. Of rudimentary organs other than those mentioned above intestine was most frequently encountered (11 cases). Of special significance is the fact that heart muscle was specifically mentioned in 7 cases. Fetus amorphus is classed as one variety of acardiac monster. In none of the cases recorded however was the heart sufficiently developed to function. It may also be permissible to question whether the muscle which was designated as rudimentary myocardium may not have been ordinary striated muscle.



Fig 3 Shown the fetus made by cutting the morpho-malton the sagittal plane. The glans tissue digested in cell found in the lower part of the left side in the right lateral half of the specimen.

end of the fetus. In the case of Crude (9) the only bones present were the sacrum and coccyx. There was no trace of central nervous system. The specimen of Kroner and Schuchardt (13) contained several vertebrae and a femur but no central nervous system. Neugebauer's (16) case showed pelvic bones and rudimentary lumbar vertebrae with a small amount of spinal cord.

Fetus amorphus in lower animals (cow and goat) presents certain differences from the corresponding human monstrosity. In the human cases the bony structures appear to have been more fully differentiated. Of the 14 cases in the lower animals one contained no bone at all and in 7 others only irregular masses of bone were present that could not be identified. Also the development of bone in the human amorphus was more massive and abundant than in the specimens from the cow and goat. No trace of cranial bones were found in any of the cases from lower animals and in only one case was there formation of vertebrae. No central nervous system was developed in any of these animals while this structure was a very common finding in the human cases. As in the human specimens the intestine was the most common of the viscera developed.

Fetus amorphus belongs to the acardiac group of monsters of which there are the following varieties:

1. Amorphus or anideus, an allantoic angiopagus twin that has never acquired the

Schwalbe (33) stated that the development of the head end only of the fetus amorphus rarely predominates and he believed that only 4 well authenticated cases were on record at the time of his writing. In addition to our own case which showed only the base of the skull and three rudimentary vertebrae the following cases appear to fall into this rare category. Bland's (3) specimen contained the base of the skull and 8 vertebrae. In that of Cornil and Cauit (7) there were traces of vertebrae and a bone which might have been either lower jaw or clavicle. In Mueller's (36) case there were skull base vertebrae ribs and scapula with brain and spinal cord. Rieck's (39) case showed base of the skull vertebrae shoulder girdle and brain and spinal cord. In the case of Helan and Abbott (43) the only bony structures were the jaw with 7 teeth and an osseous mass that was thought to be a part of the base of the skull.

The development of only the lower end of the trunk appears to be even more uncommon than development restricted to the cephalic

external form of a fetus and appears as a rounded skin covered mass.

2 Myelacephalus a more or less amorphous mass with slight suggestions of one or more limb.

3 Acornu development of the head only usually attached directly to the placenta.

4 Acephalus trunk and limbs more or less well developed but head entirely absent.

5 Ancep or paracephalus head very imperfectly developed trunk and limbs fairly well developed.

The term fetus amorphus was first used by Gurlt (46) and this type of monster was first fully described by Geoffrey St Hilaire (61) in 1839. Fetus amorphus is always a product of twin or triplet pregnancy. The co-twin or co-triplets are usually normal viable and are generally born first. When the amorphus is one of twins there is one placenta to which both cords are attached when it is one of triplets there are generally two placentas to one of which the cords of the amorphus and of one normal fetus are attached. Fetus amorphus is one of uni-ovular and monochorionic twins. The union may be either single or double. In the umbilical cord of the monster there are only two vessels one artery and one vein. The mother is usually a primipara as in our case or at least there is no history of previous twin pregnancies. The pregnancy is usually normal and is not shortened. As a rule the labor is not abnormally difficult.

The etiology of fetus amorphus is probably the same in general as that of all other types of accretive monsters. Three theories have been advanced.

1 Meckel (62) Darest (63) and Panum (56) believed that failure of the development of the heart in one of the twins was the primary condition and that the fetus amorphus survived only in those cases in which an anastomosis was formed between the vessel of the two umbilical cords.

2 Claudius (64) and Ahlfeld (65) thought that the anastomosis between the vessels of the two cords of the fetuses was the primary factor. Hunziker (42) believed that the anastomosis was artery to artery and vein to vein so that the circulation in the amorphus twin was reversed. The motor force of one fetus

overpowered that of the other and the heart of the weaker became more or less completely obliterated. The amorphus twin thus becomes a sort of parasite on the normal twin (43).

3 Schatz (66) believed that this type of monster usually resulted from some interference with the return flow of blood from the placenta to the twin which later became the fetus amorphus.

Of these three theories (1) primary deficient development in the germinal layer (2) contest of strength between the hearts of the twins through anastomosis between the vessels of the cords with overpowering and atrophy of the heart of one twin and (3) abnormally small blood vessel in the cord of one twin with anastomosis with that of the other the second is the theory that is now generally accepted.

#### SUMMARY

A specimen of one of the rarer types of fetus amorphus is described in detail. This was a kidney shaped mass covered with skin with a growth of hair on one end a rudimentary mouth and eye and the rudimentary base of a skull and three vertebrae. The mass was composed chiefly of oedematous connective tissue with blood vessels and fat and with a few fibres of striated muscle and a very small mass of glial cells and a very few ganglion cells.

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miles. Abbott and Lockhart (1903) give some interesting statistics as follows. Of 8 cases the sex was mentioned in 3, 10 of which were females. In 6 of the cases there was noted a superabundance of liquor amni. Hydrocephalus was co-existent once. Seven of the fetuses had reached full term, 2  $8\frac{1}{2}$  months, 8 months, 1 6 months, 1  $5\frac{1}{2}$  months and 1 5 months. The presentation was the vertex in 2 instances, the foot in 2 cases, the face once and the pelvis once. The monster was accompanied by a twin twice. In but 1 case was there a history of the woman having previously given birth to a malformed child.

### RECENT CASES OF INIENCEPHALUS

*B. Ins case (89)* s a colored primipara 35 of age 8 m. thsp gn t ho e bd men v rm u lv d te ded by gall flq or amn. Th e w p t neou delivery of f m le fetus e j ng 6 p un l h w g a umbilical h m h e l p a d v bbed f e t h p n a l c a l w a b f d f m the ec d m l v t brat the occip t o e c h l t g the p a l m r r w d the othe d p cal eff. The e a an b ce f shi er th p e and th s a m a l l m g c l t the b e f the s p l b f r e t

*Eda p en* the McGill University cl t (Abbott & Lockhart 1903) sm l l fem l h m k d et fle of th head th c p u t r e g w th th b c k t a p n t 4 c m t e r b o th a n u th f l o c k g m o s t d l v u p a d Th f t m e e d 30 t u r t e r l g h B th e d h n r l h p e the t e m u t e s f l e e d c e l y u p th r e l a d th l f t t i p e s a r u I n t h m i d l u r o f t h b a c k j t b e l w t h o c c p t w a d b l h e d l a t o d l t h f a b d c t g the p b f d

A second case the McGill University cl t (Abbott & Lockhart 1903) s a f l t m f m l e f t f l r m r g 33 5 e t m e t s f m the h l t h m d l f l e t e n f t n l the t r o f f e d h d b e c m n t th b a c k n t h t r a s c p u l r e g i s t u r t e r b o the Th e l t r e m i s f l e d p o t h m l t h f a l o c k e d b l q l p d f t t f t l p r d a d h a k a d Th t r u n k w s e l l n r h l Th n m b l h a l m n t h f a l u t a m a k d t l p e q u r u f l e f t f o o t a n d l i g h t f d h r i t f o o t n d a l d f t h e l m b a a d l d s a l e e Th o t g e g r a m s h e d t h b s r a n h h u p a d t h o c c u t d h n t t h b o d f t h r e b a i t h l d s a l r e g i Th m t h r f t h e f t s w a s r i c k t y d l t m f e r a l p h a l u s

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FIG. 1. Do l n d case of i cep h u s h g r a n o t o m y t h r o u h t h e y e

t t l e t l f t h d s a l a d f i r s t l m b a r e t e l r a e the arches f h h e r p e t a n d f o r m e d b o y o o f t o the g r e a t l y l r e v e d e t e l r a c a l B e c a u f t h l e f t i c l n a t i o n o f the h d t h l n the r i g h t d w e r e w i l l y s e p a r a t e d h l e t h o n t h e l f t l w e c l o s e l y j a m m e d t o g e t h e r a n d d f l e c t e d n d c a s d e f e c t n t h b o n y f r a m e k f t h t c h e s t w a l l

*H k* (91) w a 33 y e a r d p r i m p a r a Th e c h i l d w h c h s c t m t r s l g v s p e m t u r a f m l w g h g r a m s w t h a h y d r o e p h a l s a n d p e t b y t h b r e e c h I t a s d l e d p o n t n e o u s l y a f t r 12 h l b o Th p e c m e n p e s e t e d the c h c t r i t c f t e f m c p h a l Th e r o e t g r a m s h e d t h a t the o c c u p w a t t h e l f a d w n a s t h s e c o n d o r t h i r d l m b a t b r a Th e w a l s a l l d s Th s p e a l c a l w s p l t t h r o g h t l e c r v i c a l a d d s a l v t e h a t h e m e d l l a b e r y l r e

*I H* (104) t y p c a l p e c m e n o f the m t t y t h c r l p e g o c c u p g t h r e m o n o f the o c c p t l b o d e c o t s w t h t h s p i n a l c l f t W h e l r (108) h o e d x t r e m d s a l f l n w t h h o t g o f the t r u k t l d b e n g a d h e n t c l o s e t o the s a l r e g i f t h e p Th e t h o r a c a d c e r v a l s e c t f t h e p e w e m c h s h r e d t h e e n c e p h a l o c l e s w e r p s e t t h e c k a o b l i t d Th a c h e s f l l t h e t b r a e d f e c t n t t t g l g p a b f i d a Th b o d e s f l l t h c r v l d t h r a c e r t e b a n d t h e d s a l r f f t h f i r s t m t r e r t i r a f s e d i t e t h r Th a m a k e d d s a l d o s w t h m o d e r a t s c l t Th e a r s f t h t w e d f o r m e d a n d c d t n f g e n r a l h y p e t r i t p e s t



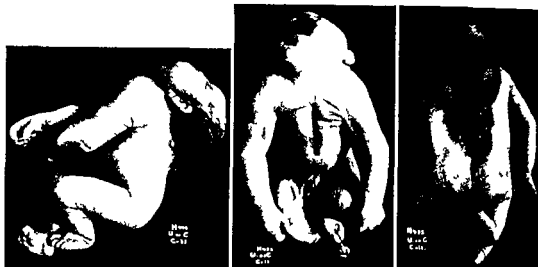


Fig. 2. In cephal (Dorsal view) University of Chicago collect

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*The l. y. n. g. Il. p. l. a. l. p. e. n. p. o. s. t. e. d. b. y. Dr. Serb. b. i. n. e. d. f. r. m. p. a. 3.3. r. s. f. g. h. h. w. e. d. a. m. o. d. r. a. t. d. g. r. f. e. l. t. r. a. t. Th. f. i. r. s. t. h. i. l. w. a. s. m. a. l. Th. p. r. n. t. l. b. o. w. a. p. m. a. t. u. r. e. a. t. 6. m. t. h. a. l. t. h. e. f. t. a. s. d. i. l. l. e. d. i. f. f. e. r. e. n. t. l. y. t. o. e. o. l. y. the o. c. c. u. p. i. t. d. i. a. m. e. t. e. r. p. o. s. t. e. r. i. o. r. p. o. s. t. Th. w. a. s. d. i. s. t. a. n. c. e. p. l. c. i. t. w. h. h. e. q. u. i. r. e. d. m. a. l. t. r. a. c. t. i. o. n. Th. f. e. t. w. a. s. a. f. e. m. a. l. g. h. g. 2. g. r. m. Th. r. a. l. g. r. p. h. f. t. h. m. i. n. s. t. e. r. h. w. e. d. n. c. e. o. f. s. y. p. h. i. l. t. o. o. s. t. e. o. c. h. d. i. a. m. e. t. e. r.*

*Il. i. s. p. e. c. m. e. n. (897) d. v. e. r. b. e. d. t. y. p. 1. f. p. h. l. The l. y. n. g. Il. p. l. a. l. p. e. n. p. o. s. t. e. d. b. y. Dr. Serb. b. i. n. e. d. f. r. m. p. a. 3.3. r. s. f. g. h. h. w. e. d. a. m. o. d. r. a. t. d. g. r. f. e. l. t. r. a. t. Th. f. i. r. s. t. h. i. l. w. a. s. m. a. l. Th. p. r. n. t. l. b. o. w. a. p. m. a. t. u. r. e. a. t. 6. m. t. h. a. l. t. h. e. f. t. a. s. d. i. l. l. e. d. i. f. f. e. r. e. n. t. l. y. t. o. e. o. l. y. the o. c. c. u. p. i. t. d. i. a. m. e. t. e. r. p. o. s. t. e. r. i. o. r. p. o. s. t. Th. w. a. s. d. i. s. t. a. n. c. e. p. l. c. i. t. w. h. h. e. q. u. i. r. e. d. m. a. l. t. r. a. c. t. i. o. n. Th. f. e. t. w. a. s. a. f. e. m. a. l. g. h. g. 2. g. r. m. Th. r. a. l. g. r. p. h. f. t. h. m. i. n. s. t. e. r. h. w. e. d. n. c. e. o. f. s. y. p. h. i. l. t. o. o. s. t. e. o. c. h. d. i. a. m. e. t. e. r.*

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My own specimen is a large full term female fetus apparently perfectly developed in every way with the exception of the craniovertebral axis which shows the characteristic features of iniencephalus. The occiput was adherent as far down as the upper lumbar vertebrae. There was a slight appearance of the spina bifida below this point but no meningocele. The facial mutilation resulting from the craniotomy and subsequent traction is evident.

#### CHARACTERISTIC FEATURES OF INIENCEPHALUS

This monster according to Taruffi (1889) Schwalbe (1909) and others must be grouped in the class of rhachischisis or fissuring of the spinal column which includes *exencephalus* with its subvarieties and *iniencephalus*. Generally there is present an occipital encephalocoele or a spina bifida with a protrusion of the spinal meninge (Hayes). The deformity consists of three cardinal features namely a backward displacement of the head and a

posterior bending of the spinal column which have given to the condition the term retro flexion of the fetus a varying degree of spina bifida affecting the upper spine and a defect of the posterior portion of the skull in the region of the foramen magnum According to Schwalbe (1909) it is very rare to find all the vertebral neural arches ununited the commoner type is accompanied by a cleavage of the occipital region of the skull he also emphasizes the exceedingly interesting feature of fusion of the ex occipitals with the vertebrae The craniovertebral axis is much shortened and forms practically a straight line from the nasal septum to the sacrum (Hayes) there is in consequence a displacement of the viscera downward The shortening of the vertical column is due to an irregular fusion or more correctly a failure in the separation of the cervical and thoracic vertebrae The neural arches of the vertebrae are deficient all failing to unite posterior to the spinal cord The ribs are more or less fused to one another and to the vertebrae from which they arise

#### ETIOLOGY OF INIENCEPHALUS

Nothing is known as to the cause of the abnormal development The older authorities Foerster Meckel Morgagni Haller Virchow and others attributed the defect to the presence of hydrocephalus and hydrorhachis More recently the amniotic theory has gained ground and this view is substantiated in a measure by Abbott and Lockhart's statistics

Apparently the primary condition is the fissuring of the spine the failure of closure of the vertebral arches appearing to be caused by the dorsal displacement of the occiput The absence of the neck is directly due to the shortening of the spinal column and the diaphragmatic hernia observed by Hayes (1922) and others probably results from the same cause Hayes suggested that the spinal malformation may be due either to pressure by the amniotic fluid or when that is deficient to pressure from the uterus itself he thinks it is more probable however that there is some inhibition of growth in the fetal spine and that the deformity does not result from extraneous forces



Fig 3 Roentgen gram of author's case

If it is assumed that iniencephaly results from a spinal arrest of development (Childs and Stockard's theory) then we must look for an embryonic stage in which there is a dorsal concavity in the vertebral axis (Hayes theory)

Such a stage is represented by His's embryo of 3.2 millimeters aged about 3 weeks Inasmuch as embryos showing this dorsal (thoracic) concavity are themselves regarded as abnormal it may be readily perceived that if iniencephaly is the result of developmental arrest at this stage it must necessarily be a very rare occurrence

#### RADIOGRAPHY OF INIENCEPHALUS

The specimens of iniencephalus which have been X-rayed show the characteristic occipital and spinal defects The occiput can be seen fused to the vertebral bodies as far down as the lower dorsal or even the lumbar or sacral regions

The lordosis is evident in all cases and

the fission of the vertebra posteriorly also can be plainly seen

## THE OBSTETRICAL SIGNIFICANCE OF INTERCELLULARS

As may be noticed from the clinical histories of the cases not every monster of this type gives rise to trouble at the time of delivery. Most of the case are premature and the small fetuses are delivered spontaneously after comparatively short labors notwithstanding the presentation by the face or the breech. An anterior chin presentation may readily be delivered without any difficulty. Nevertheless as was shown in my own case it is quite possible for extreme dystocia to re-

ult from the mon trou development in full term fetuses of this variety of teratoma.

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# ENTEROLITHS AND DIVERTICULA ESPECIALLY ENTEROLITHS CONTAINED IN DIVERTICULA OF THE LARGE BOWEL

## REPORT OF A CASE

By MILLS I. PORTER, M.D., F.A.C.S., FORT WAY, INDIANA

THE writer has met with four cases in which enteroliths were etiological factors in the condition for which he was consulted. In two the enteroliths were of biliary origin, both produced acute obstruction of the bowel by obliteration of the ileum, and both were cured by enterotomy. Two were enteroliths of fecal origin, both caused partial bowel obstruction, and both were lodged in diverticula of the large bowel, one in the rectum which was cured by removal of the enterolith through the anus, and the other in the cæcum. The latter case is reported.

Mrs. I. H., age 60 years, entered the hospital April 18, 1924, with a history of partial obstruction of the bowel extending over a period of many months. Some 5 years before she had had an attack of acute abdominal trouble centering in the right lower quadrant. The patient was fairly nourished and showed on examination nothing gave a palpable mass in the cæcal region. She had no areas of tenderness and no fever. White blood count showed 4,750 neutrophils, 77 per cent. X-ray examination showed filling defect at the cæcum. A diagnosis was made of cancer of the cæcum. Through a right rectus incision a large hard mass containing the ileum, cæcum, and appendix was removed.

a side to side anastomosis done. During the operation and after the removal of the tumor it was remarked that the diagnosis of cancer was undoubtedly correct. A tube was placed in the ileum to prevent distention, a rubber tissue drain was placed near the anastomosis, and the wound was closed.

Examination of the mass after operation proved it to be made up of bowel firmly bound about a diverticulum of the cæcum. The diverticulum contained an enterolith about the size of an ordinary hickory nut. Unfortunately after an ordinary reaction the patient gradually sank and died of exhaustion 6 days after the operation.

Postmortem examination revealed gangrene of the operative region, which contained anastomosed gut. The area seemed entirely shut off from the general cavity of the abdomen. No sign of peritonitis was present. The illustrations show the location of the diverticulum and enterolith (Figs. 1 and 2). The mouth of the diverticulum before removal of the enterolith was no larger than the end of a lead pencil, but it was dilated and the enterolith was removed before the picture was taken. The enterolith was of fecal origin.

Coerr (1) says that he was able to find only one case of fecal enterolith recorded in the

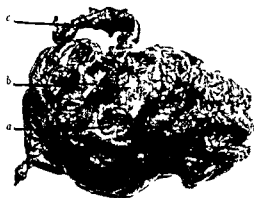


Fig. 1. Specimen removed. Enterolith. Cæcum cut. b. M. tch. n. h. l. f. Specimen removed. Enterolith. Cæcum cut. b. M. tch. n. h. l. f.

R. 1. b. f. h. W. S. g. 1. A.

Fig. 2. Specimen removed. Enterolith. Cæcum cut. b. M. tch. n. h. l. f. Specimen removed. Enterolith. Cæcum cut. b. M. tch. n. h. l. f.

literature since 1899. He says however that enteroliths of fecal origin are not rare among the aged insane. He reports a case of obstruction of the bowel by a fecal enterolith in a young girl. Rogers (9) also reports a case in which a fecolith was lodged in a diverticulum of the colon. W. J. Mayo (6) says that hardened masses of feces are often found in diverticula.

While this paper is chiefly concerned with diverticula it might be well to say in passing that many if not most of the enteroliths found in the small bowel are of biliary origin and that in making the diagnosis in the cases a history of previous cholecystitis is of great significance. McLean (7) in his paper on diverticulum of the duodenum remarks on the likelihood of food particles lodging in them and he cites one case in which twenty gallstones were found.

It is generally conceded that diverticula of the large bowel are comparatively frequent (10) and it would seem that diverticulum of the large bowel containing enteroliths is not a very rare condition. Diverticulum of the cecum however is relatively rare. The writer has met with but the one case out of more than a dozen cases of diverticula of both the large and small bowel. Cant (3) reports but one case of diverticulum of the cecum out of eleven cases of diverticula seen by him. French (1) reports three cases of diverticulitis of the cecum and remarks that while this condition is rare it is one of great interest because of the difficulty of differentiating it from tuberculous malignant disease and appendiceal abscess.

In one of his cases the correct diagnosis was made prior to operation. While diverticula of the other portions of the large bowel are frequently multiple those of the rectum and cecum are usually single.

Out of 9 cases of rectal diverticula reported by Cant (4) all were single save one and in that case two diverticula were present. This author says that of 11 cases of rectal diverticula reported by Felling the majority were from the description given evidently sigmoidal and he reminds us that that portion of the colon which is situated in the pelvis and has a peritoneal covering and mesocolon and which was formerly described as the upper third of

the rectum is in reality a continuation of the sigmoid and that diverticula located here should be designated as sigmoidal.

The diagnosis in diverticulitis of the large bowel is rather difficult. The most frequent error seems to be to mistake diverticulitis for malignancy or vice versa. The writer has met the former mistake twice according to W. J. Mayo the same mistake has occurred three times at Rochester and Schweizer reports a like mistake while in one of French cases the reverse mistake was made. It should be remembered that cancer and diverticulitis frequently coexist and that the latter is frequently the cause of the former.

Mayo says that malignant degeneration occurs in about 31 per cent of the cases of diverticulitis. To Hochenberg (5) is probably due the credit of first calling attention to the fact that diverticula may result in carcinoma. It is of interest here to note that Withers (11) described a case in which a diagnosis of either sarcoma or tuberculosis was made and in which at autopsy the conditions were found in addition to several diverticula. It is doubtless true as has been pointed out by many authors that in some cases in which diverticula and carcinoma coexist the latter may be the cause of the former although it is no doubt true that in the majority of instances the carcinoma is the result of the diverticula. Simple intestinal diverticula usually produce no symptoms and are discovered only by accident through the opened belly or during the course of an X-ray examination. A thorough X-ray examination will reveal their presence in a large proportion of cases. However in many cases the diagnosis is not completed until a laboratory examination is made.

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## GAS GANGRENE IN CIVIL PRACTICE

WITH A REPORT OF THREE CASES

BY STANLEY T. FORTUNE, M.D., F.A.C.S. AND DENVER M. VICKERS, M.D., CAMBRIDGE, NEW YORK.  
1st Mch Surg. 15 M y M. C. H. H. p. 11

**G**AS gangrene or active infection with a gas producing organism is relatively rare especially in civil practice and exact figures statistics of morbidity mortality and methods of treatment even since the World War are comparatively rare.

Maisonneuve (13) in 1853 gave the first academic description of gas gangrene. Blood good (2) as late as 1899 could find only 22 cases to summarize. And the disease remained unusual and rare until the recent opportunity for multiple contaminated dirty wounds in the fields of Belgium and France.

Welch in 1892 cultivated a bacillus from autopsy which he called *bacillus aerogenes capsulatus*. This is a long anaerobe (6 by 2.5 microns) gram positive with square ends non motile occurring clinically usually in symbiosis with streptococci and various aerobic saprophytes. The bacillus of malignant edema was described by Pasteur in 1877 and termed the *vibrio septique*. Other organisms have been described although it is probable that many names have been given to different members of a group.

These or similar organisms have been found frequently in fields in the intestinal flora on clothing in fact they seem to have a rather wide distribution. Taylor (16) reports the bacillus in 70 per cent of a series of war wound. Stitt (15) therefore remarks that it is questionable whether the pathogenicity is other than exceedingly feeble. The isolation of a large gram positive organism from a deep or lacerated wound is generally considered diagnostic with or without clinical symptoms.

The most reliable method of culture is inoculation of the suspected material into the ear vein of a rabbit quick killing of the rabbit and incubation at body temperature. If the organism is present in a few hours the rabbit will be blown up with gas and eventually be literally blown to pieces with the offensive odor of spoiled meat.

In wounds the bacillus grows usually only with some aerobic organisms (which remove the inhibiting oxygen?) or in the presence of foreign bodies dirt fragments of clothes bullets or crushed or otherwise devitalized tissues. The muscles quickly assume a dirty brick red color lose their power of contraction on mechanical stimulation and the blood supply is cut off by thrombosis of the vessels. Thus again the oxygen tension is lowered. Bowlby (3) states that he has never seen gas gangrene of the head (where the blood supply is best) and almost never in the neck. The gas itself is probably non toxic and merely mechanically allows further invasion of the separated fibers of muscle and tissue and prepares the way for the production and absorption of the hæmolytic and destructive toxins. The cause of death is not a blood invasion of the organism but a severe general toxæmia with local necrosis.

Wallace says that it is first of all a disease of muscle and spreads later to contiguous tissue. It is known to follow muscle bundles rather than jump even a short distance through fascia to attack contiguous though separate muscle groups. Early after the infection starts comes the characteristic crepitus of the affected tissues with the production of gas that will burn being 60 per cent hydrogen. Bowlby (3) quotes cases with well marked infection 5 hours after injury with death from gangrene of the entire limb in 16. Usually clinically the process occupies 24 to 48 hours but develops with great rapidity.

In the war it was most frequently seen in wounds of the buttock then in order of frequency in the thigh leg arm forearm and foot very seldom in the hand and rarely in the face neck chest and abdomen. It was reported in from 15 to 30 per cent of war wound. The mortality varied from 9 to 50 per cent depending on the length of time between injury and treatment.



Fig. 1. C. after debridement.



Fig. 2. C. after skin grafting has been performed.

In Europe therefore the infection and clinical picture of gas gangrene was common. But it is practically unknown in England and Scotland. Keen (11) did not see a single case in the Civil War and up to 1917 only one case in civil practice. C. E. Black (1) in reporting 5 cases in 10 years of private practice rightly states that many physicians have not seen a single case. Pickard (14) of Kansas City says he has seen only 3 cases in 15 years of railroad surgery. Fairbrother (5) had only one case of gas gangrene in a great many years of railroad and general surgical practice. Guthrie (8) in reporting 8 cases with 3 recoveries find that it occurred in but 1 to 644 cases treated at Bellevue Hospital between 1909 and 1911. He also states that Lothrop of Hazelton (12) in an active accident service had seen but 7 cases. Wilkins (18) of Wilkes Barre City Hospital had never seen a case. Wainright (17) of Scranton

has seen but 5. The cases reported here are 3 in 814 admissions to the Mary McClellan Hospital between 1918 and 1924 or a ratio of 1 to 938.

While most cases occurring in civil practice are found to complicate crushing wound, gunshot wounds and compound fracture the condition is not unknown as a sequel to operative surgical measures. Gilpatrick (6) reports a case of extensive gas gangrene involving the perineum, scrotum and thighs following a clamp and cautery operation for hemorrhoids with incision of an ischio-rectal abscess. Hotchkiss (9) cites cases of infection following the subcutaneous injection of salt solution and mentions a fatal case appearing on the passage of a sound 5 days after an external urethrotomy.

Keith Ingles (10) divides cases occurring in civil life into two classes according to the mode of infection. In the first group infec-



Fig. 3. Case 2. Right arm. Int. fracture.



Fig. 4. Case 3. Showing the type of injury.

tion is due to organisms from the soil originally from animal feces. In the second group infection is from the patient's own intestinal flora and is most frequently found in cases of criminal abortion (4 cases given).

Treatment has been developed largely since the experiences of the recent war. Early the rule was to amputate high above the involved tissue as soon as the diagnosis was made. Later it was found that free and radical incision removal of the affected tissue with any foreign bodies free drainage and the introduction of various antiseptics would be sufficient for a majority of the cases giving as low a mortality with less mutilation. Depage used injections of oxygen. Lawton and Whitcomb and others have been successful with hydrogen peroxide injected in and above the lesions. The majority are content with Carrel Dakin technique. The mortality rate gradually dropped in the series of cases treated during the war as the methods and technique became better known.

Bull and Ritchett (4) of the Rockefeller Institute obtained a serum against bacillus welchii with striking laboratory results and favorable clinical outcomes. The British used a polyvalent serum containing antibodies against bacillus welchii bacillus oedematis the vibron septique and bacillus

tetanus. Goodman (7) reports a recent case treated with serum from a commercial laboratory with recovery. Theoretically the serological treatment would seem logical but the case reports in prophylaxis and treatment are not altogether clear.

The case histories are as follows:

CASE 1. J. F. S., a farmer age 64 referred by Dr. J. Orton Salem New York. On the morning of the day of admission the patient while working in his barn was caught in the fly wheel of a gasoline engine lacerating his arm in a frightful manner. There were two extensive lacerations of the scalp. The skin had been stripped from the shoulder from the insertion of the pectoralis major to the external condyle of the humerus. Nearly the entire anterior and medial aspects of the arm were denuded. The biceps muscle was torn across at its middle. The coracobrachialis and the brachialis anticus were torn and crushed. The bone the brachial artery and motor nerves were intact.

Immediately after admission to the hospital the severed muscles were united by mattress sutures of chromic gut. Ample rubber tube drains were introduced and wet dressings applied. Later in the day there appeared a copious dark red discharge and it was noticed that the odor was foul. Cultures were taken and a *g.* inoculated. By the next morning the odor of gas gangrene was unmistakable. Subcutaneous crepitus was present to the axilla. The contiguous skin was brick red in color. Smears from the wound showed large numbers of large gram positive organisms some containing spores.



The guinea pig inoculated the night before and incubated for 12 hours was enormously swollen and distended with gas. Organisms similar to those of the wound were in the liver and heart's blood.

Immediate operation was performed and the biceps muscle was dissected out from its origin to its insertion and a large portion of the brachial anticus and the coracobrachialis as well as the axillary contents were removed. Dakin's solution was introduced at frequent intervals. More devitalized tissue was removed on the following morning and the emphysema was found to be stationary in the pectoral region. From this time on there was steady improvement. The wound healed by granulation and 3 weeks later skin grafting was done. The result was satisfactory from a functional standpoint; the patient is able to do his farm work with practically no impairment of power or skill.

Dakin's solution and thorough débridement seemed to be the two factors that made recovery possible. The bacilli disappeared from the deeper portion of the wound in 36 hours after the Carrel-Dakin treatment was instituted. The temperature reached a maximum of 103 degrees with a pulse of 135 during the first 24 hours and then dropped to slightly above normal for the remainder of his stay in the hospital. White blood cells 10,000; polymorphonuclears 78 per cent; transitional 15 per cent; lymphocytes 7 per cent. Red count normal.

**CASE 2.** H. E. age 3. While playing in his father's farmyard the patient caught his hand in a pulley through which a rope was passing severely injuring the hand. He was brought to the hospital 1 hour after the injury. There was extensive laceration over the dorsum of the right hand with great loss of substance and ragged edges; the entire area covering 20 square centimeters. There was a compound fracture of the proximal phalanx of the little finger with crushing of the soft part and the fingers were cyanotic. The extensor tendon of the ring finger was torn and the metacarpophalangeal joint was laid open.

The wound was cleaned, swabbed with iodine and wet dressings applied. The next morning 16 hours after injury, there was noticed the characteristic foul odor of gas gangrene and the soft parts of the little and ring fingers were necrotic and crepitant. Smears show organisms morphologically similar to Welch's bacillus. Anaerobic cultures and animal inoculation confirmed this diagnosis. The following morning there was crepitus, brick red discoloration and edema on the dorsum of the hand. Local incisions were made on the dorsum of the hand through all involved tissue. Dakin's solution was applied 6 hours after the injury was received. After the second operation the condition improved and the wound healed by granulation.

**CASE 3.** F. W. age 23. This patient was accidentally shot in the foot and lower leg receiving a full charge of small hot air rifle close range. He was received at the hospital 4 hours after injury

suffering from shock and loss of blood. The lower half of the leg was found to be riddled with shot holes. A false point of motion was present at the junction of the middle and lower third and there was considerable swelling of the lower two thirds of the leg and the ankle. The X-ray showed a comminuted fracture of both bones of the leg in the lower third.

Twenty-four hours after the accident the leg was swollen up to the knee with a brown infiltration which did not put on pressure. No definite crepitus was elicited. The temperature rose to 103 degrees and the pulse to 120. Thirty hours after the injury there was an unmistakable odor of gas gangrene and amputation was performed at the mid thigh. The patient's temperature continued at 102 degrees for 2 days and then gradually subsided. There was no extension beyond the level of amputation. Anaerobic cultures in glucose agar developed much gas in 6 hours. Recovery was uneventful.

#### SUMMARY

Gas gangrene in civil practice is relatively rare. It usually follows traumatic wounds with crushing of tissue, especially muscle and contamination with clothing or soil which has been in contact with animal excreta.

Three cases occurring in civil practice are reported. One was treated by amputation and two by thorough débridement and Carrel-Dakin technique. All recovered.

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## CARCINOMATOUS OVARIAN TERATOMA WITH PREMATURE PUBERTY AND PRECOCIOUS SOMATIC DEVELOPMENT

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A GIRL 5 years and 10 months old who had a carcinomatous teratoma of the right ovary associated with sexual and somatic precocity came under my care April 1, 1914. The tumor was removed the following day and now after ten years and eight months this patient is in good health and free from discoverable recurrence.

A first report of the case was made in *SURGERY, GYNECOLOGY AND OBSTETRICS* in May 1917. Further history is given in the present paper.

B. R. born of German parentage May 23, 1908, weighed 6 pounds at birth and grew at a normal rate until she was 4 years of age. When 5 years and 10 months old she weighed 58 pounds and was 49.8 inches tall; weight and height which are given by Bowditch and by Seaver as those of the average girl of 9 years of age. She was 20 pounds above the average in weight and 8.3 inches taller than the average girl of her age. Table I showing the average weight, height and span of arms for girls 5 to 16 years of age will permit of further comparison.

TABLE I—AVERAGE WEIGHT, HEIGHT AND SPAN OF ARMS FOR GIRLS FIVE TO SIXTEEN YEARS OF AGE

Age	From last menstruation		Weight in pounds		Height in inches		Span of arms in inches	
	No. of observations							
5	553		83		6	35		
5	54		77		6	75		
	5				6	5		
	5		83		58	5		57.9
	5		7	73	55			55.5
	5		63	9	53			5
	5		59	80	5	7		5
6	54		5	90	5	7		5
7	5		5	85	47	3		6
7	5		5		5	7		44
8	55		8		5			
8	5		38		5			3

When the patient was 5 years and 12 days old she had a menstrual period which was followed by six other periods of the 28 day type profuse and painful each lasting 1 week. The next two periods were missed. After the first period the breasts grew larger, the areolae darkened, hair appeared in the axillary and pubic regions and the whole body developed rapidly and symmetrically.

At the time of the third period a small abdominal tumor was discovered which in the next 6 months grew to such size that the patient had the appear-

ance of being pregnant at full term. She was referred to me with a diagnosis of pregnancy but on examination the normal uterus was easily palpated separate from the tumor. Pregnancy was suggested by the enlargement of the breasts and abdomen by the missed periods, by the ease with which vaginal examination was made and by nausea and vomiting which were caused by toxic absorption and by the large size of the tumor. There was no lactation in this case such as has been observed in some other cases of teratoma.

At operation the uterus and left appendages were found normal, the large tumor of the right ovary was free from adhesions and there were no peritoneal or glandular metastases. There was an excess of peritoneal fluid. The right ovary and tube and the appendix were removed and the patient made an uneventful recovery.

## PATHOLOGY

The tumor was irregularly globular and smoothly encapsulated, had a broad pedicle 2.5 inches long, weighed 4 pounds and 4 ounces, measured 7 inches in long diameter and 3.5 inches in transverse diameters. It was composed of two masses of solid tissue which were separated by two large cysts filled with thick gelatinous semifluid contents. In the solid portion of the tumor there were many small cysts and three small bones of compact texture resembling miniature cranial bones.

Dr. A. S. Warthin of the University of Michigan examined the tumor and found embryonic lung tissue, neuroglia tissue and nerve cells, tissue resembling the gastrointestinal tract, islands of cartilage and dermoid cysts containing hair, sebaceous and sweat glands. There were structures from all three germ layers: ectodermal, mesodermal and endodermal. The larger part of the growth presented the appearance of adenocarcinoma, showing in some places solid medullary masses of carcinoma with areas of necrosis.

*Subsequent history.* Since the operation the mental and physical development of the patient have been normal. At the present time she feels

perfectly well lives on the home farm and attends school in a neighboring town 5 miles away where he is a junior in the high school. The unfortunate circumstance of residing nearby has permitted follow-up examination at intervals. She has a whooping cough, chickenpox, measles, and diphtheria. The tonsils have become hypertrophied and lately small adenomata have appeared in the thyroid gland.

After removal of the ovarian tumor the breasts became small and there was no menstruation and no noticeable growth of the breast or of the pubes until the appearance of normal puberty at the age of 17 years and 9 months. Since that time the periods have been fairly regular with intervals of 28 days and duration 7 days occasionally prolonged to 14 days or two. Usually there are backache and pain in the pelvis the first day. For a short time when she was 14 years old the periods came every 2 weeks and lasted 3 days.

Measurements showing rate of growth for 1 year after removal of the tumor and for the past 20 months are given in Table II.

TABLE II — MEASUREMENTS OF PATIENT GIVEN IN INCHES

Age		Length		Breadth				Depth	
		Ht	Arm	Chest	W	Ho	Hip	Ch	Abd
5 yrs	mos	58	48	80	7	1	8.8	5.5	5.6
6 yrs	mos	63	54	85	7.5	1.5	8.7	5.6	5.6
6 yrs	6 mos	65	57	87	8	1.5	8.5	5.5	5.7

Age		Nk	Upper arm	Lower arm	Elbow to tip of hand	Wrist	Thigh	Calf	Arm	Forearm
5 yrs	mos		5	8		3.5	3	8		6.5
6 yrs	mos		5	9		4	3.5	9		7.5
6 yrs	6 mos		5	9		4	3.5	9		7.5

Before operation

In the year following operation on this patient did not grow in height although span of arms, breadth of shoulders, and girth of chest increased. It may be safely concluded that growth was accelerated by the presence of the tumor and retarded for a time after its removal.

In the 17 years and 8 months which have elapsed since the operation she has gained 14.4 inches in height, an average yearly gain of 1.33 inches, a rate below the average for girls from 6 to 16 years of age. At 16 years and 6 months of age she is 64.2 inches tall and her net weight is 100 pounds.

That rapid growth in this patient was not a family characteristic but was due to some hormone effect of the tumor is shown by the fact that her only sister, who is now 11 years old, has grown at a

normal rate and now weighs 75 pounds and is 55 inches tall. In neither sister nor mother has there been any abnormal rate of growth.

Examination made November 23, 1924, revealed no evidence of any recurrence of the tumor. Bi-manual examination showed the pelvic organs normal except for retroversion of the uterus into the left side of the pelvis. X-ray plates of the chest showed nothing to suggest any pulmonary metastasis. The liver and spleen were normal in size and no abnormal masses were palpable in the abdomen. There were no enlarged lymph glands in neck axilla or groin. Blood and urine analyses were normal.

Freedom from recurrence would now seem practically assured. The tumor was histologically as malignant as any other carcinoma and the patient is safe simply because operation took place apparently before there was any metastasis. The history of this patient would indicate that a malignant tumor may attain large size without the occurrence of metastasis.

Recurrence in cases of teratoma may appear as implantation metastasis in the peritoneal cavity or as metastasis in the retroperitoneal glands or in the liver, lungs, or other organs. The metastases may be large and contain many of the component parts of the primary tumor or they may take the form of innumerable milium nodules consisting principally of a single variety of tissue.

Scarfath, in considering dermoids and teratomata of the ovary in children up to 15 years of age, assembled 171 ovarian tumors of which only 23 were classified as teratomata. Of 20 patients operated upon for teratoma 11 died of recurrence in 6 months, 3 were released after a short time apparently cured in

nothing was known of results, 3 were free from recurrence after 1 year and 1 was free from recurrence after 7 years.

In the 21 collected cases of ovarian teratoma occurring in girls 14 years old or younger which were tabulated in my first paper only 2 patients were recorded as living beyond 1 year. One of these died of metastasis in the liver 16½ months after operation. The other patient, that of Sjoevall, was well 7 years after operation.

Luftspringer has tabulated 43 cases of ovarian dermoid and 4 of ovarian teratoma

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observed at the Breslau Clinic from April 1904 to April 1916. One of the teratomata cases was a girl 13 years old in whom there had been no bleeding and no precocity.

Croom of Edinburgh in considering premature sexual development in relation to ovarian tumors reported a case of round cell sarcoma of the ovary in a girl of 7 years and discussed the differential diagnosis from pregnancy. The girl had been raped by a boy and there was profuse hemorrhagic discharge from the vagina which continued uninterruptedly for 7 months. There was growth of pubic hair and the breasts were large. After removal of the tumor which weighed 6 pounds there was no vaginal hemorrhage.

Siegl reports a case of sarcoma of the right ovary in a girl 8 years old in whom there was abnormal growth of hair and of the genitalia.

Of all the cases of precocious puberty collected by Reuben and Manning, 3 were known to have had malignant tumors of the ovary. The question may be raised as to whether or not there is a relationship between the malignancy and the precocity.

Askantzy in his paper on Chemical causes and morphological effects in tumor patients with special reference to sexual precocity considered embryonal teratoma a kind of pseudo pregnancy and suggested that the product of fetal tumor tissue promotes maturity and incites precocious development of the genitals. According to his views the production of precocity is not a function of the organ affected by the tumor but a function of embryonic tumor tissue although only certain embryonic tissues will produce precocity. Embryonal teratomata vary in the quantity and quality of their material and this may account for varying degrees of prematurity in various cases. He stated that teratomata of the pineal gland, testicles, ovaries, kidneys, lungs, and perhaps also of the suprarenal capsules in boys and girls have been found associated with manifestations of sexual precocity.

Harvey reported a case of precocious sexual development in a girl  $2\frac{1}{2}$  years old with a history of regular menstrual period for 9 months. The precocious development was

due to a large cellular and vascular sarcoma of the left kidney and suprarenal gland.

Comby believes that precocious maturity is probably due to premature activity of the interstitial cellules of the ovary, the activity of which is produced either by some intrinsic factor or by the effects of a hormone of the pituitary, the pineal or the thyroid gland.

Krabb thinks that tumors in the pineal body and suprarenals probably cause the production of certain metabolic substances which have a stimulating action on the interstitial cells of the testicles and ovaries. But the normal suprarenal and pineal body probably have no special function in this respect.

Lwing in a paper on teratoma testis refers to cases of teratoma testis reported by Warthin and by Gabauini in which hypertrophy of both breasts and secretion of colostrum occurred and thinks it reasonable to interpret the phenomena as physiological signs of pseudogestation in the male subjects of these tumors.

It is hoped that this case of ovarian teratoma with precocity will serve to call attention to the hormone effects of tumors and to the interesting information which a follow up of cases may produce.

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ETIOLOGY OF PRE-ECLAMPTIC TOXÆMIA FROM A CLINICAL ASPECT<sup>1</sup>

BY FUCINE CARY, B.S., M.D., CH. CALIF.

THE etiology of eclampsia has in the past been deeply veiled in mystery, and in all probability will remain so for a long time to come. Nevertheless reviewing what has been accomplished on the subject and deliberating as to what bearing the different theories have on one another we find certain facts evident, namely that in several of the theories advanced as to the cause of eclampsia there is almost incontestable proof that each may have in part a definite bearing on the whole. With this in mind the author has formulated the following hypotheses which he attempts to prove from a clinical standpoint.

1. Undoubtedly there is a toxic substance or substances elaborated which give rise to the syndrome known as eclampsia.

2. This toxic substance is probably an early split product of the protein molecule.

3. The source of the toxin is not single.

4. There are three or more ports of entrance of the poison into the maternal circulation, namely from autolysis of degenerating placenta from absorption through the large intestine of split products of bacterial origin and lastly from primary foci of infection.

5. The maternal circulation is so overwhelmed by these byproducts that its power to neutralize them is diminished and thus they produce injurious effects which result in the syndrome eclampsia.

It is easy to see how Veit in 1901 when the placental theory was first considered could believe that the presence of placental cells in the maternal circulation might lead to the formation of specific antibodies. Veit and Sholten (22) produced what they thought to be a serum which caused the disappearance of the nuclei in an emulsion of placental cells and they therefore concluded that the toxic effect was due to an overabundance of placental cells.

Ascoli (2) prepared two varieties of sera, a heterosyncytolysin and an isosyncytolysin.

There was less effect from the latter and he concluded that the syncytiolysin was the toxic substance.

Weichardt (23) differs from them as to the manner of production of the poison. He says that placental cells plus blood equal syncytiolysin, that syncytiolysin plus placental cells equal syncytiotoxin, and that syncytiotoxin plus sufficient antibody equal no result but that syncytiotoxin plus insufficient antibody equal eclampsia. He used finely ground placental cells as the source of his endotoxin. Weichardt and Pilz (24) in 1906 immunized a rabbit with repeated small doses of syncytiolysin and emulsion of placenta against a large dose of endotoxin.

Liepmann (15) was unable to obtain cytotoxicity with specific sera but thought he found a precipitin.

Wormser (25) proved all these results inaccurate and showed them to be due to blood contained in the tissue used.

Pollak in 1904 (20) and Aronson in 1903, both failed to detect syncytiolysis and precipitation with specific sera in a larger series of animals including rabbits, goats and horses than the others had used.

Frank (10) used another method—placental nucleoprotein that produced a more sharply specific reaction and the deflection of complement which had been proved more delicate than precipitin reaction. He also used rabbits' serum made lytic by hen's corpuscles. He also found the serum reaction due to the contained blood.

Labhardt (12) criticizes Ehrlich's side chain theory promulgated by Veit. He says the very foundation of the theory does not seem sound for the trophoblast is a product of a maternal cell and it is not logical to consider it foreign to the mother and thus capable of producing antibodies and toxins. Furthermore eclampsia is rare in the early months of pregnancy when syncytium is abundant and vice versa. Why does it not

occur in extra uterine pregnancy when abortion simulates the injection into the peritoneal cavity?

In 1900 and again in 1906 Weichardt and Pilz (24) experimented with the filtered extract of placenta. They claimed to obtain endotoxin both by mechanical action and cytotoxicity of the placental cells. After grinding and passing them through sieves and gauze they mixed in a definite amount of salt solution and claimed a test toxin which when injected intravenously in doses of 1 to 3 cubic centimeters produced death. Postmortem examination showed almost universal thrombosis. Smaller doses caused death by respiratory failure and therefore they concluded that two toxic elements existed one acting on the respiratory center and the other coagulating the blood.

Freund confirmed the above but on trying to separate the two elements found them non-toxic after passing them through a Berkefeld filter and concluded that the toxin was adherent to the cell particles. He obtained the same result with other glandular organs.

Lichtenstein (14) denies these results *in toto*. He ground the placenta to a graduated fineness and secured the following results:

1 cubic centimeters of emulsion (very fine) caused widespread thrombosis throughout the body. Two cubic centimeters was injected after passing through filter paper with no ill effect. In animals injected with emulsion filtered more finely, no effect was obtained. A suspension of *agrilla* (a fine clay) was made and the first injection was repeated with the same result. When filtered as in trial two and when trial three was tried he obtained the same result. He concludes therefore that death is due to multiple emboli and denies the toxicity of the extract.

Englemann and Slade in 1909 (8) prepared an extract by using the Buchner press and after centrifuging and pipetting it off a large series of injections were made. They confirm the results of Weichardt and Freund. They next used hirudin to inhibit the coagulation and obtaining negative results concluded that the toxic effect was in coagulation only.

More recent works prove that nucleo-protein gives the same effect and that the

toxicity is due to the nucleo-protein in the extract. Acconci and Botavi prepared nucleo-protein from the placenta and found coagulation of the blood the cause of death.

Dryfuss in 1908 (7) produced the test toxin of Weichardt and on injection got the same result. Then he got the same result with the precipitated nucleo-protein. An animal was then injected with test toxin from which the nucleo-protein had been precipitated and no ill effect resulted.

Savare (21) took a solution of fibrinogen freed from globulin which failed to coagulate after standing several days. Placental extract was added and coagulation occurred in 3 hours at 37 degrees C. Blood containing placental tissue caused coagulation in 30 minutes. He concluded that coagulation lay with placental blood instead of with cells.

Mohr and Freund (18) dried the placenta *in vacuo* at 30 degrees C and extracted it with ether. They isolated a sodium oleate a lipid with hæmolytic properties. Human corpuscles were hæmolyzed by 0.005 gram. Maternal and fetal serum inhibited its action.

Liepmann in 1905 began work with eclamptic placentas. He minced and dried the placentas *in vacuo* and then ground them into a fine powder (sifted sugar). One gram in salt solution was injected into the peritoneal cavity of a rabbit. 113 experiments were performed. The effect resembled eclampsia. Most of the rabbits died and when death did not occur convulsive disturbances were present.

He also found that the toxin in the placenta of less severe cases of eclampsia was more toxic and vice versa. The degree of severity was judged by the number of fits.

Frank and Dryfuss found no difference in the effect from eclamptic and non eclamptic brains when injected into animals.

Bergell and Liepmann (3) were among the earliest investigators of the ferments of the placenta. They allowed placental extract to act on various substances and noted the resultant changes. Their findings were as follows: ferments acting on carbohydrate—diastase, lactase and glycolytic ferment. Proteolytic ferments were very powerful. Lipolytic ferment was not demonstrated.

Controversy continued until 1907 when Savire eliminated all blood and found no invertase, tryptinase, aldohydrase or glycolytic ferment but found proteolytic ferments. He also found a blood coagulating ferment, a deamidizing ferment and erepsin. He could not be sure that the deamidizing proteolytic ferment was not a postmortem change and he thought diastase and oxida e might be connected with metabolism of placental tissue.

As to the autolysis of the placenta, Mathes in 1901 (16) found abundant formation of albumose, leucine and tryptin in Br 0 (1903) found the soluble nitrogen increased 100 per cent after 7 days autolysis. Drysdale in 1901 (7) made a thorough investigation of autolysis of eclamptic and non eclamptic placentas with the following conclusion:

Autolysis takes place during life in the eclamptic placenta. The process is more than a simple autolysis since there is a relatively greater increase in the amide nitrogen compared to the total nitrogen. This shows that deamidizing ferment is more active than proteolytic. Then two possibilities arise. The placental stasis is either the cause of eclampsia or it is only an isolated phenomenon or effect of the disease.

The study of eclampsia by Young and Miller (26-27) was carried out from two viewpoints: the clinico-anatomical which concerned itself with a description and interpretation of the symptoms and morbid changes present and the experimental in which an attempt was made to reproduce the symptom and morbid change in lower animals.

From recent investigation into the cause of eclampsia has issued the belief that pregnancy is the cause and that the toxin produced originates from the placenta. In partum eclampsia is inconsistent with this view but something of a chemical nature must have been left behind.

The following considerations that eclampsia and albuminuria of pregnancy are due to the liberation of products of the early autolysis of the placenta are brought forward:

1. The toxæmia is especially associated with the recent infarction of the placenta.

2. Placental infarction is due to an interference with the maternal blood supply.

3. The interference with the blood supply which is responsible for the infarction is not dependent upon the toxic state and in point of fact may occur in the most extreme form when there is no evidence of a toxæmia e.g. accidental hæmorrhage.

4. The placenta is so constructed that if a part of it die, the products liberated from the dying patch can pass directly into the blood stream. The cases of accidental hæmorrhage associated with a toxæmia are those in which part of the placenta remains attached for sometime after the separation of the adjacent part by a retroplacental bleeding. The necrosis liberates the toxic material.

5. When the placental disease is gradual in its onset there is more chance of the evolution of the infarcted patches.

These facts all suggest that the toxæmia are due to the autolytic products liberated in the early stages of the placental death. By imitating the process *in utero* it has been possible to isolate from the healthy placenta a material or materials of a soluble kind which will reproduce the clinical features and the morbid changes peculiarly characteristic of eclampsia. These are (a) convulsions, (b) peripheral focal necrosis of the liver and (c) degenerative changes in the kidneys. In partum eclampsia may be due to a small piece of retained placenta.

From the experimental reproduction of eclampsia in lower animals, Holland (11) draw the following conclusions:

1. The primary cause is to be sought in the placenta.

2. The specific placental theory of Vait must be considered no longer tenable. The various specific placenta reactions (syncytiolysis, precipitans, etc.) whether produced naturally or experimentally in animals do not exist.

3. Placental extracts possess no special toxicity for animal beyond causing coagulation of the blood and death from extensive thrombosis.

4. The eclamptic placenta has no special toxicity.

5. The activity of the intracellular ferments of the placenta are increased in eclampsia. (The most probable theory of the cause

of eclampsia is an intoxication of the body by the passage of ferments and autolytic products from the placenta into the circulation the principal effect of which is an increased coagulability of the blood and the activation of autolytic ferments in other parts of the body).

6 The conditions of the eclampsia are caused by placental degeneration due to interference with its blood supply

7 Placental infarction is due to thrombosis or mechanical detachment of the placenta

8 Absorption of the placental poisons occur only through the portions of the placenta attached to the uterine wall

9 Toxæmia may be associated with placenta prævia and ablatio placente

10 The major symptoms of eclampsia are due to absorption of the broken down liver cells and possibly other tissues which are killed by the placental poison

To the theory that in the placenta lies the cause of the syndrome known as eclampsia an especially notable contribution has been made by the Japanese worker Isei Obata (19) who has carried out his work with two principal questions in mind

1 Are the eclamptic placental extracts toxic?

Does the serum of eclamptic women possess the same ability to neutralize the toxins which the placenta may elaborate as that possessed by the serum of normal gravidæ

In answer to the answer to the first question Obata took fresh specimens of placenta made blood free ground and mixed them with three times their weight of normal salt solution and allowed them to stand at room temperature for half an hour This mixture was then strained through silk and the resulting supernatant fluid was centrifuged and thus freed from all particles

Japanese dancing mice were used except in one or two instances when rabbits were substituted

Injections of lethal doses of the extract caused clonic rarely tonic convulsions in 10 to 30 minute followed by dyspnoea coma and death in from 1 to 3 minutes Even

when death was postponed the almost constant presence of the two symptoms dyspnoea and convulsions pointed strongly to a condition at least simulating eclampsia as seen in the human subject

Observation was made that there seemed to be no relation between the size of the dose given and the body weight of the animal

The experiments were repeated with normal placental extract and it was found that the dose required to produce the convulsions was very nearly the same as that required from the eclamptic material being 0.025 to 0.10 cubic centimeter for the former and 0.019 to 0.1 cubic centimeter for the latter

Injection of 0.3 cubic centimeter of fresh serum from men normal gravidæ and puerperal women caused symptoms differing from those caused by the eclamptic extract only in the slightly longer time elapsing before the onset of the symptoms

Serum taken from eclamptic women both during and after an attack produced essentially the same syndrome

From the above results one might deduce that the placenta of eclamptic women is not in itself sufficiently toxic to produce eclampsia and that search must be made along other lines to find its real causative factors

The second question under consideration had to do with the neutralizing power of the eclamptic serum as compared with that of the non eclamptic women

One cubic centimeter doses of eclamptic placental extract were mixed with fresh serum varying in amounts from 0.7 cubic centimeter to 0.025 cubic centimeter normal saline being added to make each injection total cubic centimeters These were incubated 1 hour at 37 degrees C Controls were used consisting of 1.0 cubic centimeter placental extract and 1.0 cubic centimeter normal saline

It was found that the serum from men pregnant and non pregnant women possesses practically the same power to neutralize the eclamptic extract—0.1 to 0.3 cubic centimeter of the sera neutralizing 1 cubic centimeter of the placental extract of the eclamptic However it was found that the serum taken during an attack possessed this power to a



noticeably diminishing degree and that serum taken each day succeeding the attack showed a gradual increase in its neutralizing capacity reaching the normal on about the fourth or fifth day postpartum.

Therefore it would seem that the serum of eclamptic women does show a marked deficiency in its ability to neutralize the toxins thrown into the system by the placenta but that this power is gradually restored postpartum.

In addition to the above observation it was noted that the serum of normal gravidæ possesses a neutralizing power which is no greater than that shown by non-pregnant women thus proving that no immunological process can account for the neutralizing power present in the blood of the non-eclamptic gravidæ.

Postmortem examination of the animal used in the above experiments showed practically the same changes in the liver, kidney, lungs, etc., as are found postmortem in the human subject. An exception to this is the apparent accelerated coagulation of the blood which points strongly to an intoxication.

The conclusions to be drawn from the work of Obata would be that

1 The extract of eclamptic placenta is not sufficiently toxic as compared with the normal as to justify the assumption that therein lies the cause of eclampsia.

2 The serum of eclamptic women is markedly deficient in its ability to neutralize the toxin elaborated by the placenta.

3 This deficiency is not caused by the convulsions.

4 The normal neutralizing power is restored by the fourth or fifth day postpartum.

It would seem therefore that from Obata's work the statement might be made that Eclampsia is an intoxication by placental poison made possible by a lowered capacity of neutralization on the part of the maternal blood.

Believing that the toxic agent in eclampsia is due to a large protein molecule the result of autolysis the author performed the following experiments.

A normal placenta was obtained in a septic condition as possible and freed

from maternal blood by repeated washing with sterile normal salt solution. Then the placental vessels were irrigated with sterile normal salt solution at 2 meters pressure for about hours rendering the placenta perfectly white and free from blood. To insure the tissue being free from contamination and blood cubes were cut from the center leaving both the fetal membranes and that portion which came in contact with the maternal structures behind. These cubes were next put into a sterile meat grinder and ground as finely as possible.

This finely divided mass was added to twice its volume of sterile normal salt solution and incubated for an hour after which it was filtered through a fine silk screen. To the slightly turbid filtrate was added 1% per cent phenol and the mixture was then sealed in sterile glass ampules which were kept in the refrigerator.

After standing it was noted that each ampule contained a light amount of white sediment and that the supernatant fluid was perfectly clear. In the experiments only the clear fluid was used.

Healthy non-pregnant guinea pigs were used in these experiments and the fluid was kept sterile and injected intraperitoneally.

*Experiment 1* 1 g. No. 1 given 0.5 cubic centimeter of 1% phenol extract with no result. 1 g. No. 2 given 1 cubic centimeter of placental extract with no result. 1 g. No. 3 given 2 cubic centimeters of placental extract. In one minute pig became irritable.

*Experiment 2* Pig No. 4 given 2 cubic centimeters of placental extract. In one minute pig became irritable. Given 2 cubic centimeters of 1% phenol extract 15 minutes later. In three minutes pig lay down. Chloroform inhalations summing eclampsia. This repeated at frequent intervals for 3 hours with ultimate recovery.

*Experiment 3* Pig No. 5 At 4:44 p.m. given 2 cubic centimeters of placental extract. At 4:46 p.m. pig developed tremors with acute flushing of ears. At 4:49 p.m. there was incontinence of urine and feces. At 4:55 p.m. pig given 1.5 cubic centimeters more. At 4:59 p.m. a repetitive series of convulsive movements.

*Experiment 4* Pig No. 6 At 4:16 p.m. given 2 cubic centimeters of placental extract. At 4:19 p.m. pig became restless and jumpy. At 4:26 p.m. pig apparently recovered. At 4:35 p.m. pig given 2 cubic centimeters more. At 4:36 p.m. pig again jumpy. At 4:40 p.m. convulsive seizure. Labored respirations. At 4:44 p.m. much recovered still twitching.

At 4.46 p.m. given 2 cubic centimeters more. At 4.50 p.m. severe convulsions pig on its back eyes fixed abdomen distended. At 4.58 p.m. convulsions over pig still irritable. Pig No 7. Repetition of above experiment with same result. Pig No 8. Repetition of above experiment with same result.

*Experiment 5.* Pig No 9. Given 2 cubic centimeters pregnant horse globulin with no result. Given 2 cubic centimeters more on second day with no result. Given 2 cubic centimeters more on third day with no result. Given 2 cubic centimeters more on tenth day with no result.

*Experiment 6.* Two cubic centimeters of pregnant horse globulin was mixed with 6 cubic centimeters of placental extract and incubated for 1 hour. Pig No 10. At 4.46 p.m. 2 cubic centimeters of this mixture was given. At 4.48 p.m. 2 cubic centimeters more given. At 4.52 p.m. very slight tremors noted. At 4.55 p.m. condition normal. Pig No 11. At 4.46 p.m. 2 cubic centimeters of mixture was given. At 4.56 p.m. 2 cubic centimeters more given. At 5.00 p.m. 2 cubic centimeters more given with no reaction.

From the above experiments we may deduce the following facts

1. By extracting with normal salt solution placental tissues (free from blood) which have been incubated for an hour we are able to obtain a substance toxic to guinea pigs when given in doses of cubic centimeters or more intraperitoneally.

2. This substance is quickly absorbed into the circulation of the guinea pig and it seems to be soon neutralized.

3. If the extract be incubated with one third its volume of pregnant horse serum (globulin) for 1 hour its toxicity is destroyed.

The foregoing 1. at least rather striking evidence that there is a substance elaborated by autolysis in the normal placenta which in laboratory animals will give symptoms simulating eclampsia. But may not this be only one source of origin and may this toxic substance not be elaborated in other parts of the body as well?

Stroganoff believes in the bacterial theory of eclampsia and LaVake (13) in 13 cases of toxæmia and eclampsia found a primary infection in the teeth tonsils and sinuses. He also demonstrated the presence of streptococci staphylococci and colon bacilli and emphasizes the fact that in eclamptic cases (1) there is a history of infection (2) there are demonstrable foci of infection (3) and that multipare having previous normal preg-

nancies and labors gave definite histories of symptoms of infections occurring since the last labor and especially during the pregnancy in which eclampsia occurred.

LaVake also agrees with Ross McPherson (17) that eclampsia may be due to intestinal stasis superimposed by colon bacillus and streptococcal infections.

Overeating and constipation may contribute to the predominance of a putrefactive type of organism in the large intestine resulting in putrefactive changes in the mucus present in the colon under these conditions.

Gibbon Fitzgibbon (9) brings out the fact clinically that there is a tendency in toxæmia cases toward overeating and constipation. It has also been noted by many German writers that during the war when the protein consumption was low and the diet contained relatively more roughage and the women were forced to greater activity there was a great decrease in the number of eclamptic cases.

Davidson and Miller (6) in the Royal Maternity Hospital Edinburgh found that during the rationing period of the war the incidence of eclampsia diminished to two fifths the usual number of cases and believed that this was due principally to the decrease of protein in the diet at that time.

The author has reviewed the above etiological factors and has endeavored to bring out the fact that in all probability there is no immune reaction in eclampsia but that there is a toxic substance or substances elaborated that are responsible for the end results. From the above the conclusion may also be drawn that the source of the toxic substances may be varied and it is the author's belief that the symptoms encountered are the result of an accumulative action and that the placenta is not the sole malefactor.

On a free protein diet a putrefactive type of bacteria is developed which is capable of splitting the mucus formed in the large intestine into a toxic substance that may readily become absorbed in the circulation. Also certain noted writers such as Stroganoff and Rossnau believe in a bacterial origin and call attention to focal infection and the presence of fever in these patients.





# DEPARTMENT OF TECHNIQUE

## TANNIC ACID IN THE TREATMENT OF BURNS

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THE various phenomena associated with extensive burns have long engaged the attention of investigators in the fields of physiology, pathology, and clinical medicine. While as yet there has been presented no single theory which satisfactorily explains all of the observed changes following the primary burn, several more or less plausible theories have been advanced. Of these three may be discussed briefly.

The reaction of the body to a burn strongly resembles the clinical state described by the term *toxæmia*, which implies the presence in the circulation of some toxic agent. The more serious cases usually present early in the course a clinical picture commonly described by such terms as shock or exhaustion. There is a profound disturbance of the circulatory and of the heat regulating mechanisms and in all probability equally serious interference with many other functions of the body. MacLeod (24) states that the extent of the burned area is of more importance than the depth. He further writes as regard prognosis that a burn of even mild degree may cause a fatal issue and that this is almost inevitable in an adult if the area affected is more than one third of the total body surface. This is in accord with the observations of Klawer (1). Authentic cases in children are recorded of burns of apparently slight severity which have been followed by death. On the other hand patients with much more severe burns are known to have recovered and to have shown but a mild general reaction. There seems to be something especially harmful in a superficial burn.

The theories which have been evolved to explain these phenomena may be arranged roughly into the following groups: (1) Those in which interference with the normal function of the skin is considered to be the essential factor in the causation of phenomena; (2) those in which the effects observed are attributed to changes in the blood resulting in altered function; and (3) those in which the picture is explained on the basis of absorption of a toxic substance in the bloodstream.

### THEORIES OF INTERFERENCE WITH NORMAL FUNCTION OF SKIN

A disturbance of one or another of the various functions of skin, namely respiration (13), excretion (9), temperature regulation (10, 19), and sensation (31) has been made the basis of theories explaining the clinical course which follows extensive burn. The data that have been presented in support of the theory that failure of the respiratory function of skin in mammals results in overwork of the viscera is entirely unconvincing. The theory of retention of normal excretory products of skin was shown to be untenable by the work of Kizantzin (16) who demonstrated that the ill effect of girdling experimental animals is due to the abnormal biological conditions produced in the skin rather than to the retention of excretory products. He showed that girdling destroys the vitality of the area covered and that the microscopic picture is not unlike that seen in first degree burns. Welti (43) disproved the theory of failure of the heat regulating mechanism by showing that animals die in spite of adequate protection against such heat dissipation. Markuffel and Steinhaus (25) discredited the theory based on the sensory function of the skin by demonstrating that interference with the nerve supply to a burned part in a rabbit had no effect on the constitutional reaction while division of the blood supply prevented it fairly effectively. This conclusion has been supported by the work of Kotzareff (18) who found that division of the nerves to the burned extremity in a guinea pig did not diminish the severity of the toxæmia.

### THEORY BASED ON ALTERATION OF THE BLOOD

It has been established that after burns concentration of blood takes place (2, 22, 29), the erythrocytes undergo certain morphological changes (34, 44), there is some loss of function of the red blood cells (14, 20) and thrombosis frequently takes place (44). In the opinion of Hoppe Seyler

(15) the erythrocytes are not sufficiently altered either morphologically or functionally to ascribe serious trouble to such changes. He did not observe as much free hæmoglobin in the plasma as would be expected were the erythrocytes injured in great numbers. Robertson and Boyd (32) emphasize the fact that there is a greater increase of urea nitrogen than of total non protein nitrogen. Underhill (39) believes that the increase of non protein nitrogen and urea nitrogen is best explained on the basis of blood concentration.

#### THE TOXÆMIA THEORY

There is certain convincing evidence that suggests the formation at the site of the burn of a toxic substance the absorption of which is responsible for the constitutional reaction. The first reported autopsies were those of William Cumin (6) published in 1823. In cases of early death the chief lesion found was hyperæmia of the thoracic and abdominal organs while in instances in which death was delayed several days there was observed a well marked inflammatory reaction. Bardeen (3) in a very admirable study of 5 fatal cases in children who ranged in age from 16 months to 8 years and who died from 4 to 9 hours after being burned observed degenerative changes in the liver spleen kidneys and bone marrow. He further noted a general oedema of all lymphoid tissue which was most marked at the germinal centers. The alterations observed were nearly identical to those found in lymph glands of children who die of an acute infection like diphtheria in which it is known that a toxin is present in the circulating blood. He concluded that the changes were of sufficient extent to make it unnecessary to assume a nervous factor as the cause of death and that the phenomena observed were best explained on the basis of an acute toxæmia. Weiskotten (42) and Olbrycht (27) from studies of autopsy material arrived at the same conclusion but emphasized the degenerative changes in the adrenals.

Reiss (30) succeeded in isolating from the urine of burned patients a substance toxic for animal which had many of the properties of pyridine. The finding of toxic agents in the urine has been confirmed by numerous investigators (1, 16, 23, 37) but there is no agreement as to the identity of the toxic substance present.

Vogt (41) and later Vaccarezza (40) observed that when parabiosis was established between two animals and one was burned the other showed evidence of toxæmia. The symptoms in the burned animal were observed to be less severe under such circumstances than when it was alone. It was further demonstrated that toxic symptoms

did not develop in the unburned animal when it was separated from the burned animal within the first 12 hours but both animals finally died of toxæmia when left united.

Pfeiffer (28) isolated cleavage products of protein decomposition from burned skin which were found to be neurotoxic and necrotoxic. These he described as being soluble in water alcohol and glycerol and insoluble in chloroform and ether. Robertson and Boyd (32) have also demonstrated the toxicity of the products of protein autolysis in burned tissue. They concluded that the toxic material was composed of two elements one which is thermolabile non-diffusible and necrotoxic the other is thermostable diffusible and neurotoxic. They further showed that the toxin circulated in blood either in or was absorbed by the erythrocytes because whole blood was found to carry the toxic principle while blood serum was found poisonous only in enormous doses when given intraperitoneally to guinea pigs.

The clinical course which follows extensive superficial burns cannot be attributed to interference with any of the functions of the skin nor can it be ascribed to the known changes of the blood. While these are doubtless contributing factors they in themselves do not adequately explain the phenomena observed.

Of the various theories presented therefore that which attributes the constitutional reaction to absorption of some toxic substance or substances from the burned area is most strongly supported by the available evidence.

The clinical and experimental facts suggest that the rational manner of combating the toxæmia would then lie in some form of local treatment which would prevent the absorption of autolytic products of protein decomposition. This might be accomplished (1) by arresting the autolytic process (2) by removing the products of decomposition mechanically or by baths (3) by slowing the process of absorption by the use of vasoconstrictor drugs and (4) by causing a local coagulation of all devitalized tissue.

There are data available which show that the rate of autolysis *in vitro* may be controlled by changing the hydrogen ion concentration of the tissue. Wiener (45) found that the intracellular proteases act only in a faintly acid medium and that their activity is entirely checked by a slight shift to the alkaline side of the neutral point. There has been clinical application of this principle in the widespread use of sodium bicarbonate compresses and baths in the treatment of burns. This phase of the problem warrants further study.

There is a great deal of evidence in favor of making a much closer watch of the use of gas in an effort to eliminate tetanus. Yet (41) Johnston and Hild (32) and others have demonstrated that early complete removal of the burned tissue will prevent the development of tetanus. Briger (5) has been using a much nearer tissue use, a possible ulcer general area, the very large doses of morphine and then washing the bleeding surface with gasoline. Fisher (21) outlines a similar treatment. The use of these energetics measures is followed after the primary period of collapse. There are clinical cases, however, in which the vitality of the patient might be taxed to such a degree by this therapy that a case with an otherwise favorable prognosis might conceivably end fatally. Further, the idea of minimizing a general anesthetic cannot be accepted lightly in view of the fact that there is no question of the lungs as well as of the abdominal viscera. A number of us have attempted to obtain the same result by continuous bathing with away the water, but it is that the amount absorbed would be minimal. This is generally known as the H. Frazer treatment, although Rose (11) calls attention to the fact that Fracavanti was the one who introduced it.

Dugli (8) found in studying a method of training the process of absorption in turn that when the rate of a fall it was altered trychnine sulfate applied to the surface was primarily absorbed and gave rise to typical trychnine convulsions. However when the surface was first treated with procaine an injection in a dilution of 1 to 5000 the rate of absorption was so diminished that convulsion did not occur. He applied this principle clinically in the treatment of laryngeal spasm being able to release the tissue of the larynx as it was possible so that the spasm would not be overwhelmed by a single massive dose.

The fourth possible means of limiting absorption of the toxic material by coagulation or precipitation of the injured portion was suggested by the writer by the observation of Haeffler that the toxic extract is inactivated by a frequently used 1 per cent. 1:1000 solution of mercuric chloride. Mercuric chloride has often been applied to burns to combat secondary infection. Launier<sup>1</sup> is using a 1:5000 solution in an advanced method of continuous irrigation. Shale has also used a 1:1000 solution on compound fractures. In view of the fact that there is a large absorbing surface this treatment is not without danger.

TABLE VIII

While investigating the solubility of unglycosylated fibrinogen, the writer was advised by Dr. C. M. Allen of the University of Tennessee that in the study of the solubility of precipitated protein, tannic acid (7, 20, 38) is a non-nitrogenous amorphous powder which is readily soluble in water, glycerine and alcohol but insoluble in ether and chloroform. It precipitates protein alkaloids, some glucosides and the salt of the heavy metals. It forms a more stable compound with the protein constituents of the body fluids and cells. When applied to a filtered urticae in dilute solution, further penetration into the deeper living protoplasm apparently prevented the action and the true antrient effect appears to be limited exclusively to the most superficial layers of the urticae. Schuetz (15) has shown however that when first applied in concentrated solutions, the tannic acid may penetrate before superficial coagulation has occurred and in such an event a deeper antrient may result. The precipitated protein in the urticae treated previously with a protective coating against chemical irritation and mechanical action as well as against sensory and inflammatory irritation. When tannic acid comes in contact with the fluid in a test tube it precipitates the protein when a minute trace intravenously it acts similarly to that of the precipitating small antrient. It is thus may be concluded that the effect of tannic acid is limited to the point of application.

For in the foregoing consideration of the properties of tannic acid it is evident that it might be self-catalytic in glycolating the polysaccharide material in turned to use and thereby in preventing their absorption. It was with the idea of determining its value in this respect that the present investigation was undertaken.

It is noteworthy that gastric acid which has some properties in common with hydrochloric acid is found to have been used extensively in the treatment of burns for its desiccant and analgesic action. The chief objection to it is that we have seen the facts that it is highly irritant is not marked in the concentration used and that symptoms are not infrequently observed when its employment is extensive.

## CONCLUSIONS

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Fig. Case 1. Second degree burn of both hands and forearms. Right dressed with boric acid compresses for 48 hours. Hand macerated. Left dressed with 5 percent tannic acid solution for 4 hours. Hand was dry smooth homogenous surface. No edema. A tannic acid protective layer of gelled update and dehydrated tissue.

In Cases 5 and 6 when the tannic acid treatment was followed with compresses of boric acid the tissues became macerated and a weeping surface appeared. However on exposure to air the devitalized epidermis promptly dried and within a few days separated as large dark scales from a surface which was covered with new soft pink epithelium.

Case 7. 434 J. B. white male aged 45 years admitted to the hospital on May 5, 1944 for treatment of burns of the face and neck. Inhalation of illuminating gas. His temperature was 98.6 degrees Fahrenheit. Respiratory rate 20 to the minute. The second degree burns involving the face, neck, both hands and forearms. The urine

showed glucose present but otherwise as negative. (For details of blood studies see Tables I and II.)

Fluorides were for the arms and hands were dressed with vaseline gauze and as the line was applied to the face and neck but no dressing was placed on the face. On May 5 the burns were covered with necrotic epithelium which was beginning to separate. There was much exudate present. The urine became glucose free after the first specimen. The vaseline gauze dressings were discontinued on the arms and 5 percent tannic acid compresses substituted. The following day May 6 the arms were quite dry there was no exudate present. The compresses were continued for a total of 48 hours and at this time the burned surface had become a light brown color and was clean. Vaseline gauze again was used for a dressing.

The temperature varied from normal to 101.4 degrees Fahrenheit the third day and after that did not become elevated. The patient was discharged on May 9, 1944 at which time all the burns were healed except a few small areas on the left arm.

CASE 8. N. 443 J. B. S. a white male age 26 years was admitted to the hospital on May 23, 1944 for treatment of a burn. He had been working near a kettle of boiling which upset and splashed over his face and clothing. His temperature was 97.6 degrees Fahrenheit. The pulse 72 and respiratory rate 18 to the minute. The exudate was multiple. Second degree burns of the face for the chest back and the rear arms which measured from 10 to 25 centimeters in diameter.

The burns were covered with compresses substituted with 5 percent tannic acid. The following day a satisfactory circulation had been obtained and the burns had become necrotic. They were then dressed with vaseline gauze. No symptoms of toxemia developed. Healing occurred promptly and the patient was discharged on the tenth day following the accident.

CASE 9. N. 434 J. A. B. C. a white male aged 12 years was admitted to the hospital on May 5, 1944 for treatment of burns which resulted from an explosion of a gas can. On arrival at the hospital his condition was good. Temperature was 98.8 degrees Fahrenheit. Pulse 72 and respiratory rate 20 to the minute. There were second degree burns involving both hands, forearms, upper back and the neck and the face. About 5 percent of the total body area was burned. Urine was negative for sugar and albumin.

The burns were dressed with vaseline gauze. Flare-ups were followed. The patient was given morphine when necessary. Frequent intervals. On May 10 the burns were

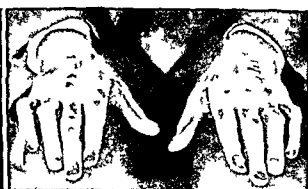
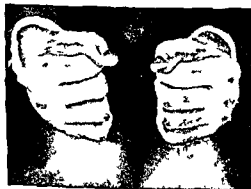


Fig. 3. Case 3. Photograph taken on the fifth day. II. Lung completely normal. No deformities. Very slight limitation of motion.



Fig 4



Fig 5



Fig 6

Fig 4 Case 3. Photograph taken 7 months after the accident.

Fig 5 Case 3. Photograph taken 7 months after the accident.

considered that although epithelium there was a great deal of the process the rectal temperature varied from 101.6 to 103.1 degrees Fahrenheit. The lungs were clear with 5 percent tannic acid compresses. Temperature for the result of the treatment was 101.6 degrees Fahrenheit.

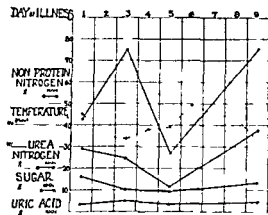


Fig 7 Case 4. Significant electrolyte imbalance. The patient turned normoalbuminemic. Protein nitrogen level decreased to 15 mg per 100 ml. Blood urea nitrogen level decreased to 10 mg per 100 ml. Promptly the patient was given 100 cc of 5 percent tannic acid compresses. The patient was given 100 cc of 5 percent tannic acid compresses. The patient was given 100 cc of 5 percent tannic acid compresses.

Fig 6 Case 3. Photograph taken 7 months after the accident. No signs of contracture of the eyelids are present at the time this normal.

As a result of the treatment, the patient seemed a little better. The patient was given 100 cc of 5 percent tannic acid compresses. The patient was given 100 cc of 5 percent tannic acid compresses. The patient was given 100 cc of 5 percent tannic acid compresses.

In Cases 7, 8, and 9, tannic acid precipitation was followed by the application of vaseline gauze. The extreme maceration like that seen after the use of boric acid was not seen, nor did symptoms of toxemia develop. Although the application of vaseline to the coagulated tissue softened it, there was nothing observed to suggest that it hastened separation of the devitalized tissue.

Case No. 44106. H.D. White, male, aged 43 years, was admitted to the hospital May 1924 for treatment of a fracture of the right femur. The patient was given 100 cc of 5 percent tannic acid compresses. The patient was given 100 cc of 5 percent tannic acid compresses. The patient was given 100 cc of 5 percent tannic acid compresses.



Fig 8



Fig 9



Fig 10

Fig 8 Case 6 Ph t g ph taken 18 hours alt r the  
b n h w sec nd de r burn of face a d th r d g e  
bare f right e r

Fig 9 Case 6 Ph t g ph tak n th r t y th d d y

He lug f eco d degre burns c mplete Thord de r e  
bu n of e r g anu l t

Fig 10 Case 6 Ph tograph tak n g m nth s ster b rn  
sh wing d t n of ear nd f c

e pr a n z t th m u te The w a c o d g e e  
burn f th nt e f e a d l p h c l n t p r o t e c t d  
b y h s r The n e h d sec nd de g e b r n wh l th  
ears w r b r n e d t th th r d d g e See F p s 1 2 a l  
13 (Blood f d g s a e h n T a l l I a n d II)

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m m a l e c t a l m p e r t u s 4 d e g r e e F n M y  
6 th l a h e e b e g u n n i n g t o p r a t e a n d t h f a e n d  
h d e r c r d w th r o x d t A s s e r e t t a n  
d l u t r w a l t u t e d f t h e b o i u d A r u n d  
th y 5 p e r t t m t f t a n n i d s d O n  
M y o s a t i f t o r y a g u l a t i n h i l o c u r d a l t h e  
l n e t h e x p o e d t t h r Th u r l e m a e d  
d r y a n d g r a u l l y r e s l I p d m s e p a t e d The  
t e m p e a t r m a n d n r m l t r t h n n t h d f c t l  
f a r a s a g s b g u n M a b The p a t n t s d  
h g d o f 6 n d t t h t i m e t h e k n o f t h e f a e  
l o s e b u t t l l q t e e d

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u t H p n Th c d d g e b u r  
t h l f t h a d a d n t f r m Th e r w a e c d d  
g r b u f t h g h t h d t d n g u p r d n l n g  
t h l o a r m t h y t u r e f t h m d d l n d p p e t h d s  
T h e w a o n d d g e b u f t h h n a d n g h t a  
a d a f r s t d g e e b u r n f t h e c k a n d m a n d e f t h e  
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a p r a t i c a l l y m p l t e

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a e n l d g r e e b u r n o f t h e t r e l u t t o c k l o b a c k d  
p r o t e c t a p c t o f b t h t h s U n n w s n e g a t i e f r  
l b m n a d s u g s

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s p r e n t i n a i l l u t i A f t e 4 h u r t h s u l c e  
s d r y a n d t h b l e b s h d b r o k e n t h u r f a c e w a  
b o w n o l w h i l e t h e t a l u z e l e g u d m w s a l g h t e r  
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9 4 s t b u r n i n g n l y a f m a l l a r a r e m a i n e d p e n

C A S E 4 N o 46945 B C w h i t e m a l a g e d 57 y e a r s  
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p a t e t r p p e r r i g h t a r m a n d n e c k H s t e m p e t i e w a s  
98 d e g r e e s F u l o g a n d r p i a t n w a 18 t o t h m i n u t e  
T h e e c o n d d e g r e e b u r n o f t h e e n u u p p e r  
t h d o f t h e g h t a r r x t n d i n g a r o u n d t o t h e a r i l l a T h e r  
w a s a l s o a e c n d d e g r e b u r n f t h e l o w r t h r d o f t h e u p p e r  
r m e c t n d g o e r t h e l b o x a n d i n o l r g t h e u p p e r  
t h d o f t h l o e a r m w i t h s m a l l b r n s o n t h e n e c k



Fig 11



Fig 12



Fig 13

Fig 11 Case 11. Thotg ph tk n 8 h uraft r c  
e dent sh ing sec n l f green fent ref lscalp  
third degre t r f

Fig 12 Case 11. Th t graph t k n thirty third d y

A gau e c mpress w i mediat ly applied wh h w s  
sat rat d with 5 per cent t i a l i s l i t i n Th re was  
p ompt rel f from pa an l n sed ti w necessary fr  
sleep On July 1 the dress g stem ed thout cu

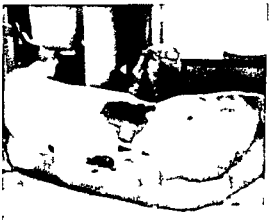


Fig 14 Case 5. Th bl k res r eco d d k  
b rn At the aist th b t b nd f b edsk  
wh e th p t nt a b l th l d his cl thes tightly ag st h  
body Th re is a sm l white re f u b r n e d k i at  
th ngle f th right sc p la Th rem d of the kn  
f th back wh h i slightly dark r deat d d nt the  
knees s frst degre b rn F rty ght per t of the  
t il body f ce b rn d

Healing f sec n l degree bu mplt l t t rmal pag  
m ntat n t l l b e t Th rd degre b rn fe gra l t g

Fig 13 Case 11. Th t graph t k n thirty third d y  
l l r m l N t r a c t u r e n s e r

g a n v d s c m f r t t n ly a part al coagul t i o n h d been  
t t ed A 5 p e t s o l u t i o n f t s c a c d w then  
sed O J l y 11 th n t r a t i o n a d u m i n h e d t  
p e r c e n t f i t h c t e d t l j l y 15 at h h  
t u m h a l g a w l l w l m o s t f t h e d t  
l i z l p f e r m h d p a r a t e d Th b u r n s r e t h n e x p o s e d

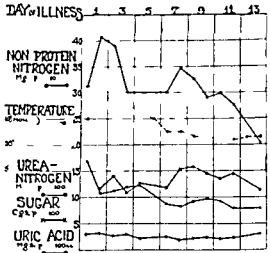


Fig 5 Case 5. Th blood n prot n nitrog and  
urea trog n rem in d p t l l y t h a n n r m a l l i m i t  
B r n s i n l e d 48 p t f t h t t l b o d y r f c e



Fig 16 (left above) C e 6 Se d d gree b rn f  
back sh wing m rk d c gul t act of t nn cid  
sol ti

Fig. 7 (left) Case 6 Second degree burn of the hands and a third degree burn of the upper arm.

Fig. 8 (right above) Case 16 Sec. 2nd degree burn of chest and abdomen

Fig. 9. Case 6. The c. g. lat. d. l. y. o. r. the second degree burn has. p. a. t. e. d. and th. e. d. g. e. s. h. a. v. e. b. e. n. t. r. i. u. m. d. w. a. y. e. x. p. o. s. i. n. g. a. d. r. y. i. n. t. a. c. t. e. p. i. t. h. e. l. i. a. l. s. u. f. a. c. e. P. h. o. t. o. g. r. a. p. h. t. a. k. e. n. s. s. i. v. e. n. t. h. d. y.

t a duri g the day a d at night w e p t ct d with  
selin gau During the nti pe od of h sp talizat n  
th t mper ture r m ined normal Th t nt w ds-  
charged on July and t n time did the n n prot in  
t ge urea t oren uri a d rise abo n mal

Cas      A    80    MI C    hte m le ged 49  
 y ars wa dm tted th he pit lo lug t8 9 4 fr  
 teaten nt of burns b h ult d from fllng nt ta k  
 fo lng wat r dre ng sat ated th bo d  
 solution had p euly be ppli d Th pat nt w s n  
 llapse Th temp t e 64 deg s F pulse 7  
 nd q te ompes bl and th r prst nws 8 to the  
 minut The ski w cld d r rd with a pr i se  
 sweat Th exp si w s nxu u the pin was n t se

[illegible]

After the primary period of depression the temperature rose to 100 deg c F. The dressings were changed about 5 hours after admission. On the evening of the second day the burns of the left arm and upper left arm, left hip, right flank and the right arm and hand showed a first degree burn. There was a first degree burn starting at the above mentioned points extending downward over the entire abdomen and thighs to the knees.

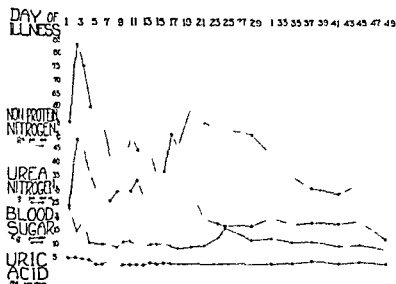


Fig. 2. Case 10. The blood nitrogen, nitrogen, urea nitrogen rose promptly from the burn, gradually returned to normal. The blood sugar was 100 milligrams per 100 cc. until the 15th day, then it rose to 150 mg. per 100 cc. During the last period, when the arm and legs were dressed with 1 cc. solution of subsequently with Dakin's solution, there was a rise in protein nitrogen.

knees lost for the first day green burn, but the m. l. l. (the sc. p. l. t. n. l. g. d. a. r. i. e. t. h. b. t. o. c. k. s. n. l. thigh t. l. l. knees. Th. l. y. v. l. l. skin of l. l. a. l. w. r. e. l. e. a. r. m. n. l. the w. l. s. w. r. e. the p. a. t. i. s. t. e. l. t. h. l. l. h. l. c. l. t. h. t. h. l. g. n. t. h. l. l. l. y. l. y. a. t. l. m. r. m. n. t. 45 per cent. fibroblast u. f. a. w. l. m. e. d. (l. g. 14). Th. u. e. c. t. a. i. n. e. f. l. s. e. l. t. n. e. g. t. e. f. r. y. t. h. m. e. t. a. l. b. u. m. i. n. (l. g. 15). F. l. o. o. d. t. l. e. t. l. l. a. d. d. l. l.

l. l. u. d. w. e. f. e. r. i. t. o. o. o. o. c. u. t. c. t. i. m. t. r. s. l. y. l. h. r. e. h. n. d. e. d. c. l. c. t. i. m. t. f. s. p. e. c. t. s. o. l. u. t. n. f. l. g. c. s. e. i. n. m. l. s. a. l. e. r. e. g. i. e. n. e. r. y. j. l. r. s. p. e. r. i. t. m. Th. e. l. n. w. e. d. s. e. f. t. e. r. t. h. y. r. e. e. r. d. w. l. l. y. j. l. p. e. r. f. i. l. l. e. l. l. k. o. r. h. l. g. i. m. p. r. e. s. p. l. e. d. Th. k. p. m. t. o. d. w. l. t. s. p. e. r. s. o. l. u. t. i. n. s. t. a. n. n. c. l. l. t. e. m. p. e. r. a. t. u. r. e. s. e. t. t. o. 4. l. g. e. e. f. t. h. d. y. f. r. e. t. a. l. n. t. o. l. t. h. n. g. r. a. l. u. a. l. l. b. e. c. m. e. l. r. e. m. i. n. i. g. r. m. a. l. t. e. r. t. h. s. e. n. t. h. d. y.

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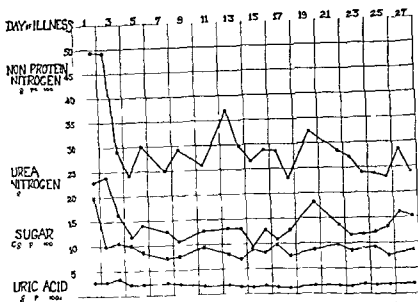


Fig. 21. Case 8. The blood non protein nitrogen, urea nitrogen and sugar remained within normal limits after the first 4 hours. Burns involved 47 per cent of the total body surface.

The following upon moving the dressings a satisfactory condition was observed. The burns presented a light brown dry homogeneous surface. The patient continued to vomit and the rectal temperature rose to a maximum of 100.5 degrees F. The concentration of the non protein nitrogen was elevated to 30 mg per 100 ml. The best water exposed to it. The percentage of non protein nitrogen in the arms until August 2, at which time they were exposed to air. On August 3 the left arm placed in boracic acid compresses. The wrist and elbow joints were not affected. The right arm was placed in a malleable compress and the hand and wrist were left free. During the period the oxygenation of the tissue gained (see Fig. 9). On the 4th the kidneys showed a high rate of diuresis. The diuresis continued until August 9, when a pleural effusion was diagnosed.

The extent of the burn on the chest as it developed was approximately 18 days. The degree began to loosen and could be removed. Each day the trachea was intubated. The patient was able to breathe through the tube. The procedure was so successful that the patient could breathe through the tube. The patient was able to breathe through the tube. The patient was able to breathe through the tube.

Case 8. A 47-year-old male, hit by a car, was brought to the hospital on October 9, 1944, for treatment of burns. The patient was in a state of shock and had a pulse of 140 per minute. The temperature was 100.5 degrees F. The blood pressure was 100/60 mm Hg. The patient was given 1 liter of normal saline solution. The patient was given 1 liter of normal saline solution. The patient was given 1 liter of normal saline solution.

The temperature rose to 100 degrees F and then gradually fell to normal. The compresses were continued on the hands for 8 hours. At this time the burned skin was a light brown and the epidermis over the blisters which had previously been punctured was dry and wrinkled. The blisters were then exposed to air and no further dressings were used. The patient's condition continued at the same time. The lesions were dry and remained so. The child was discharged from the hospital on October 15 at which time the face and hands were still covered with adherent dry desloughed epidermis. There were still few crusts on the left hip. At this time the degree of involvement was 47 per cent.

Case 8. No. 47448 M T, a white male, age 137 years, admitted to the hospital on July 21, 1924, for treatment of burns. The patient was in a state of shock and had a pulse of 140 per minute. The temperature was 100.5 degrees F. The blood pressure was 100/60 mm Hg. The patient was given 1 liter of normal saline solution. The patient was given 1 liter of normal saline solution. The patient was given 1 liter of normal saline solution.

The patient was burned and was dressed with compresses. The patient was burned and was dressed with compresses. The patient was burned and was dressed with compresses. The patient was burned and was dressed with compresses.







Fig 24 Case 23 Photograph taken on fifteen th day  
A Normal skin B First degree burn C Intact dry epithelium place under second degree burn D Crusts over second degree burn



Fig 5 Case 25 Photograph taken 24 hours after acid burn showing second and third degree burn of entire forearm

patient but stumbled a different on his face and hands. He succeeded in tracheotomy and was dead.

On arrival at the hospital his temperature was 98 degrees Fahrenheit pulse 90 and respiration was 20 to the minute. There was a second degree burn of the feet which had been protected by heavy shoes and woolen socks which had formed a pot of the charred mass which conducted heat poorly. There was a third degree burn beginning at the tips of the toes involving both legs in their entirety and the perineum and buttocks to the crest of the iliac bones. On the lateral aspect of the thighs cutaneous fascial layers were exposed, no burn. The entire third degree burn of the neck and scalp a neck. Fifty-three per cent of the total surface area was burned. The patient received trace of albumin. Blood findings were normal in T. B. I. and II.

The burns were dressed with compresses kept moist with 5 per cent tannic acid solution. A hypodermoclysis of 500 cc of normal saline was given on the 8th day. The patient was placed in a tank of 6000 cc of entombed in a straited bed. The patient was further treated with small doses of strychnine and benzoin and adrenalin. Five per cent tannic acid was used for 8 hours and for the following hours a 25 per cent solution was used.

After 20 hours the burns were exposed to the dehydrated tissue was a dark brown color and the thighs where subcutaneous fat was exposed the skin was dry and leathery. The patient's plasma was a mottled cream color with a thin sheet of fibrin. The bed was draped with sterilized linen. Both the bed and lamps were placed to provide heat. The patient was forced to 500 cc of centimeters of fluid. The first 48 hours did not contain albumin and blood. Rectal temperature rose to maximum of 103 degrees Fahrenheit August 25 while it reached 104 degrees Fahrenheit. The blood showed no remarkable retention of nitrogen. Nitrogen in protein or nitrogen (F. G. 3).

On the ninth day the patient's condition was digitized. After exposure to air the burns were not dis-

turbed further until the twelfth day. At this time large masses of burn debris which had been coagulated were trimmed away. In places this exposed subcutaneous fat. During this entire period the patient complained very little of pain except in his hands which showed thrombosis of the vessels of the fingers and thumbs.

On August 8 transfusion of 350 cubic centimeters of citrated blood was given. The patient was irritative at times but when spoken to always gave an intelligent answer. There were neither vomiting nor diarrhea but distention was a disturbing symptom. Another transfusion given on September 4. At this time because of unavoidable pressure the thighs and the buttocks perineum and lower back upon the reparation of the deeper pressure sores which were infected with bacillus coli. Because of the extent of the lesions it was possible to keep the patient on his side only a short time and this necessitated disturbing some of the injured part. This broken down area soon involved the thighs where the skin in its entire thickness had been destroyed. Efforts were made to keep this clean by trimming away sloughs as rapidly as they separated, packing carefully with hydrogen peroxide and then painting the area with a 1 per cent solution of acid fuchsin. On September 4, 5 and 6 there was little change in the condition of the patient. The rectal temperature was still higher than previously. The non-protein nitrogen and urea nitrogen were also at a low level. The pulse was irregular and regular in rhythm the rate varied from 100 to 130. Urine continued. There was no change in the patient's mentality.

Early on the morning of September 7, 1924 the patient vomited some bile stained material. He spit up some blood stained mucus. Examination of the throat revealed very marked infection and this was considered the source of the blood. A voided specimen of urine showed a slight trace of albumin but otherwise was negative. The patient went to all peace and died the same day the electrolyte secondary after the acid nit.

CASE 2 No 5863 J. P. a white male aged 56 years was admitted to the hospital on November 1, 1924 for



Fig 26 C Hot graph t k n n f t y t h d y

tre time t of c ust c od b r n H t m p r a t e a s  
99.4 degs F p l 7 d respiration v a s 8 to the m n  
ut Th e a s a s e c n d d e g e b b g n g t the  
r i s t e n c i r c l i n g t h f r m e x t e n d i n g u p w r d n d i n  
l g t h e l t h i r d t h o f t h e p p m Th u d d  
n t c o n t a i n g r o a l b m A m p s w a p p l i e d t  
the e t a r m d t h i s a k e p t m t e d w i t h 5 p e  
c e t t n c c i d s o l u t i o n A f t e o b t h w m o d  
The u f c e w a s y d a l g h t b n o l The r m  
w s t h n x p d t o i r a c r a d l e s p l c e d o v t d w  
d a p e d w i t h s t e l e l O n m b e 4 t h t m p  
t e a h e d n r m l d d n t b e m l a t d s b s  
q n t l y Th r e m n e d n g t e f o r a l b m n a s t s  
a d b l o o d e l m e n t A u n u r y f t h e b l o o d f i n d g s  
c o d e d n T a b l I d i i

A f t t w e l e d a y s t h e d r y h m o g e n e o s c r u s t s b e g a n t  
s p t n d b e e a t h t h e e w a n n t c t s m t h  
e p t h e l l s f a E h d y t h c l i d p d g e s e r  
f l l y t m m d y w t h o u t d i n g t h t t h  
P c

The p t i n t w a s d s c h a r g e d n N e m b e r 924 t  
w h i c h t i m e t h e l e s w s h l d e p t r e l  
b o u t a c e n t i m t d m t t h f r m h r e p  
t h e l i z a t n w s t m p l t Th e e s r e o d  
w t h l n g

C s e 3 N 337 o W L a w h i t e m a l a g d 5 y e a r s  
d m u t t d t o t h e h o p t a l n N o m b r 3 924 f  
t e t m e n t o f b r n l i n g f r o m f i l l g n t h l l o  
t k o f b o i l i n g w t

H s t m p r a t w a s 99 d g F p l 6 a n d r e s p  
a n a t t h m i n t Th s e d d g b r n  
f b o t h l e g b g n g t h k l n d t e d p t  
t h e k n e Th w e c d d g b r n m a s r i 5  
c e n t m t r s w d t h 30 t u m t s l e g t h o n t h  
p o s t p e t o f t h g h t t h g h t l e t h d f t h  
t h g h l d f i r s t d g e b Th u n c o t a i d  
t f l l m (B l o o d f i n d g e i n T a b l I a d  
I I)

The b r n r e c v e d w i t h c e l l o s l k a n d c o m p r e s s  
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a n d s h o d n o e v d e o f g u l a t I t w a s b e l i e v e d  
t h t t h e s o l t i d n t s t e d t h o g h t p e r f o t n s  
G a u e m t e d t h t h e s a m s o l u t i o n a s t h p l a c e d  
n d i r c t c o n t a c t w i t h t h e b n e d a r e a d c o t i n u e d f 18  
h o u r s U p n r e m o l t h e s u f a c e w a s l h t b o w n c l o r  
d d r y Th e u z e a d h e d a t f w s m a l l s Th  
b u r n s w e t h e n e x p o s d t o a f t e r f i r s t d r a p i g s t n l  
l n r t h e m Th e t e m p e r a t u r e c h e c k e d i t s m a x m m  
o n t h e t h d d y f t e r t h c e i d e t w h i t b e c m e l e v t d  
t r i d g r e s F a d a f t e r t h t h d v r m e d n o r m l

O n e m b e r 14 t h s o n d d g e b u r n s w r e r e d  
w i t h l a g d r y s c a l w h i c h w a n r e m e d l e d a s u r  
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c a u i n g t r a u m a t o t h n e v d r i y i g p t h l l c l l s Th e  
f o l l o i n g d v c m p l e t m v a l o f t h g u l t e d l a y e s  
a c c m p l h e d Th t u r e a r e w p i t h e l a l i z d Th p  
t e t w a s d c h r g e d o N e m b e r 2

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s n I I t e m p e r a t u r e 100 degs F p l s e 90 a d r e  
p r a t o n e 8 t o t h e m t Th r e s e c o d d e g r e e  
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l f t h d n d w r t Th e f i r s t d g r e b r n f t h  
n h t h a n d d w r t a n d t h m a i n d e r o f t h e f c e d  
l i g h t e

The h d a d b d e e p l a c e d g u z c o m p r e s s  
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f s a t f c t o r y c g u l t i o n w a s b t m e d

The p a t i w d s c h a g e d n N o m b e r 4 t w h i c h  
t i m d s q m t i o n w r l l d a e d o n t h e a s b r n d  
t t h f i r s t d e g e e w h i l e t h e s e n d d g e e b u r n s w r e  
e d w i t h l g t h k d r y s c a l h h h e m o e d  
e l e d a l h e a l e d e p t h l l b

C A S E 5 N o 522 J S h t e m l a g d 35 y a r s  
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f l m m b l e m a t r i a l d i t p o e d o e r h h e d n d r i g h t  
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r e p r a t n 2 t t h e m u t e Th e w e t h i r d d g r  
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g h t h i d s u m f t h l f t h d d d m o f t h  
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m a n d e o f b o t h h d d r i t r e v l e d s e d d g r e e  
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m i n g n t m e t e r s n l g t h d 7 c e t u m e t n  
w d t h Th u n c e n t a n d f t t f a l b u m n (S e e  
b l o o d f i n d g e s i n T a b l e I d i i) (F g s 5 n d 36)

The b r n s w e d d w t h a m p a t u r a t e d t h  
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h d t h b e t h e n e p o s e d t o Th e m u  
m u m e c t i t e m p e r a t u r e o c c u r r e d n t h e d d y w h e n  
t e a h d 4 d g F R e c t l t e m p t e s d d o  
s h w t h w d r i t n s o o f t e c e n a b o f t h e  
t y b t t d m e d i n s t a n t l y b e t w e e n 99.8 a n d  
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d y A t h c g u l t e d t i s s s e p a r a t e d i n t a c t e p t h  
l l f p n d c e p t e t h t h i d d e g r e e b u r n o f  
t h l f t h d A f t e r t h f i r s t w t n f u h s t h e u r n e  
r m m e d l b m f A p n c h g r a f t s d n o t h e d  
o D e c m b e 8 H l u n g w a s p r a c t i c l y m p l t o D  
m b e d t h p t i n t w a s i n c d u t n o t b d c h r g d

## COMMENT ON BLOOD FINDINGS

In Table I are summarized the results of blood analyses for non protein nitrogen, urea nitrogen, glucose and uric acid. It will be seen from inspection of these data that the blood sugar and the non protein nitrogen are generally elevated during the first 24 hours after the burn. The degree of elevation of these substances is usually directly proportional to the severity of the burn. Since the level maintained in many of the treated cases was normal or but little above normal after the first 24 hours it is worthy of note that a marked increase promptly followed the application of a wet boric acid dressing to burns in cases previously treated with tannic acid only.

In Table II are presented the repeated blood counts and hæmoglobin estimations in 19 cases. The most important feature to be noted is the almost uniform occurrence of leucocytosis. In 2 cases only was there any blood concentration if we may judge by the percentage of hæmoglobin and the number of red blood cells.

## METHOD OF PROCEDURE

The method finally adopted in the management of cases of burns may be briefly described as follows. As soon as the patient is seen he is given a relatively large dose of morphine sulphate hypodermically (for an average adult  $\frac{1}{4}$  grain) to alleviate the intense pain. The burned area is then covered with dry sterile gauze pad which are held in place by sterile gauze bandages. This dressing is then soaked with a 2.5 per cent aqueous solution of tannic acid. This is thought to be the most desirable concentration although solutions of dilute 1.5 or 75 per cent and a concentrated 15.5 per cent have been used in some cases described. It is essential that the tannic acid solution be made up fresh just before use because it deteriorates upon standing with the formation of the far less astringent gallic acid.

In order to prevent the deep caustic tissue injury found by Schuetz to follow the application of concentrated tannic acid small sections of the dressing have been opened for inspection at the end of 12 hours, 18 hours and again at the end of 4 hours. As soon as the part is found to have assumed a light brown color all dressings are removed. In order to facilitate removal of the dressings without pain to the patient and without causing further trauma it has been found desirable to wet the gauze with fresh tannic acid solution shortly before this is done. The wound is thereafter left exposed to the air but is carefully protected from mechanical injury, chilling and bacterial invasion by a suitable cradle draped

with sterile linen. In the more serious cases artificial heat has been supplied by placing within the cradle so prepared one or more ordinary electric light bulbs.

In a few cases 5 per cent tannic acid ointment (made with equal parts of vaseline and lanolin as a base) was substituted for the aqueous solution. Although it appeared to have a definitely beneficial effect it is far less efficacious than the former. The chief value of the ointment is in its use about the eyes where the astringent solution cannot be used with entire safety.

One of the most essential features of the management of all burn cases is that of keeping up the fluid balance in the body. This is accomplished by forcing fluid by mouth where possible or by hypodermoclysis, proctoclysis or intravenous infusions according to the special indications in each case. Blood transfusion has been employed in some of these cases apparently with favorable effects.

## DISCUSSION

The foregoing review of case histories of burns treated with tannic acid brings out a number of striking facts in favor of the employment of this method of treatment.

In the first instance it is notable that the degree of toxæmia observed in the series of cases treated consistently with tannic acid solution was markedly less than that following other burns of similar extent and severity. Evidence of reduction in the intensity of the toxæmia is seen in the clinical behavior of the patients, the relatively low temperature curve, the slight degree of blood concentration, the comparatively low level of the non protein nitrogen of the blood maintained and finally the low mortality rate from primary toxæmia.

It is believed that lessening of the toxæmia should be attributed to precipitation of the toxic material of the burned tissue by the tannic acid applied since such an explanation is in keeping with all of the observed effects produced *in vitro*. The maintenance of local tissue dehydration by direct exposure to the air is probably an important factor during the early period of treatment. This not only prevents loss of body water but would appear to keep the toxic material out of solution. This explanation is strongly suggested by the cases in which symptom of acute toxæmia developed promptly following the application of moist boric acid dressing to the dry encrusted surface.

The low rate of mortality in this series of cases is worthy of special note as evidence of lessened toxæmia and of reduced incidence of infection.

TABLE I—SUMMARY OF BLOOD FINDINGS FOLLOWING BURNS NON PROTEIN NITROGEN  
UREA NITROGEN URIC ACID AND SUGAR

[illegible]

TABLE II—SUMMARY OF BLOOD COUNTS AND HEMOGLOBIN PERCENTAGE FOLLOWING BURNS

Ca	D	R B C pe M H m	C b	H B C t	W B C pe C M H m	U	D	R B C pe M H m	C b	H B C t	W B C pe C M H m
	5-6-	65	00		37		7 0-4	365		67	4
	5-24	36		66	5	7	7 2-4	375		71	11
							7 3-4			69	5,800
							7 5-4	39		78	3
3	5-6-	54		00							35
	6-6-	57	000				7 5-4	3	00		4
	6-3-4	303		7	6		7 3-4	39		8	95
5	5-6-	7		6							
6	5-6-4	56		8	80		8 7-4	535			5
							8 8-4	7-85		70	60
							8 8-4	8		86	78
							8 9-4	450000			
							8 0-				
							0-3	575		95	
9	5 5	7		87	00						
	5 7-4	3		80	0		4	45		73	
	5 8-	417	00	88							
	5 9-	303			83		3	37	00	65	500
	5	171	00	73	6					8	84
	5-6-	53									
	7 0-4	45		94	83		8 4	447		9	4
							0-4	400000		18	800
							-10-	39	000	58	6
								00	00	86	86
5	8-6-24	5			65		-23-4	7			400
	8 5-2				65						
	8-6-	8		3	3		0-	46	000	9	000
	8-7	3						4	00	63	9600
	8-8-4	000		34				06		64	00
	8-9-	9	000				4 4	3500	00	74	98
	8 0-						7	375	00	7	3
	8 1-	35		83			8-	3400		68	7300
	8 2-	1000	00	89	60		9-4	3	00	74	5
	8 3-							300	00	83	4500
	8 4-						5	5	00		3

Of the cases presented 5 showed burns involving considerably more than one third of the total body surface. Of the 2 fatal cases it is now felt that 1 (Case 4) might have lived had his burns been treated throughout as were the others instead of by application of boric acid solution on the sixth day of treatment. The second fatal case (Ca e 21) lived 22 days but finally died of exhaustion and secondary infection of the deeply burned and macerated tissues about the perineum low back and legs at a time when the non protein nitrogen of the blood was normal and other evidence of the so called burn toxemia was absent.

Since the comfort of the patient in any form of therapy is a most important factor in determining its value it is worthy of emphasis that the analgesic effect of the tannic acid is one of its most striking features. The burning sensation complained of by the patient has generally been relieved within one half hour after application of the dressing and no further severe pain has been experienced. After removal of the tannic acid compress the dry coagulum which presents is insensitive of palpation and exposure to air has not resulted in recurrence of pain. Narcotics have rarely been used in the series of cases treated with tannic acid after the first injection on admission

and at night when it was felt that their use was desirable to insure complete rest. Much of the discomfort usually experienced by burned patients is due to exhausting and traumatizing dressings. With this method the patient is spared these experiences after removal of the primary dressing usually at the end of the twenty fourth hour.

In the non fatal cases of burns the most distressing feature is usually that associated with scar formation resulting in the disfigurement and partial incapacity. In the present study it has been most gratifying to observe a marked diminution in the amount of such scarring. This is doubtless due to 3 factors namely a great decrease in the incidence of infection, decrease in the amount of irregular granulation formation and the provision of a superficial crust which acts as a bridge for the spread of new epithelium over the burned area. These effects are all dependent upon the nature of the change produced in the tissue a change which gives rise to a condition similar to that seen in the Vosburgh treatment of granulating wounds.

On removing the tannic acid compresses from first degree burns one observes that the degree of erythema is far less marked than usual and in some cases there is a total absence of redness. In



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## THE USE OF PARAFFIN AS A PRIMARY DRESSING FOR SKIN GRAFTS<sup>1</sup>

By FREDERICK A COLLIER M S M D F A C S ANN ARBOR MICHIGAN  
 A SOCIET P FESSE F S G Y L R S TY F MICH

THE importance of skin grafting as a method of promoting healing preventing and correcting deformity has become generally recognized only in late years although it is one of the first operative procedures to appear in medical history. Its field of usefulness has been steadily increasing due largely to the work of plastic surgeons who have enunciated clearly its principles and placed them on a rational basis. The utilization of the free full thickness graft and the pedicle flaps of various types in reconstructive procedures requires a special knowledge and interest and should not be attempted by the casual artisan in this field unless he is prepared to fulfill these requirements. A general surgical service however presents countless opportunities for employment of that simple form of graft the Ollier Thiersch type which are not as yet grasped by everyone. As a method of hastening the repair of granulating wounds or of covering fresh skin defects it is easy of application and fairly sure of result with a saving in time and comfort of convalescence distinctly worth seeking. The principles of its use have been well established and its technique fairly well standardized but some difference of opinion still exists among surgeons as to the most satisfactory method of postoperative management. An experience of 8 years with a paraffin dressing for the Ollier Thiersch skin graft has led us to record it. Many types of dressing have been advocated of both the moist and the dry varieties especially popular are gutta serena strips silver foil adhesive plaster paraffined mesh gauze and open air under screen held. None of these however have proved as satisfactory in our hands as the method here described. It is undoubtedly true that factors aside from the form of dressing applied after grafting are responsible for a large

part of the success or failure of the procedure and that no method will obviate assiduous and pains taking care but other things being equal the final result will vary with the technique of post operative dressing.

The use of paraffin as a primary dressing to the Ollier Thiersch graft is mentioned by J S Davis (2) without enthusiasm and its use as a late application to grafted surfaces is described by Douglas (3). The method has been used by us in about 150 cases in this clinic during the past 5 years with results that have been satisfactory. Prior to this time it was used in No. 22 General Hospital B E F during the years 1916-18 on a fairly large number of cases. We have used the Ollier Thiersch graft for the types of cases usually advocated that is to cover granulating wound of traumatic or surgical origin fresh traumatic or operative skin defects and ulcers of various types. This type of graft is never used on surfaces exposed to trauma nor applied to surfaces liable to contracture as the flexor aspects of joints as it must be born in mind that this graft does not prevent contracture of underlying or surrounding scar tissue. The paraffin method of dressing is obviously not used in grafts in the mouth or around the eye where wax mold after the method of Esser (4) are used.

We believe that the best results are obtained by grafting on normal tissue rather than on a bed of scar tissue and that the thicker the cicatricial bed the less likelihood of a take and a satisfactory result. Whenever possible old granulating areas to be covered are excised and the graft applied to the more nearly normal underlying tissue. Recent granulating surfaces are prepared for grafting by the application of Dakin's solution every 2 hours the exuberant granulation





Fig. Cutting graft to remove it by throat stick covered with gauze

being removed with scissors as often as necessary to keep the surface smooth and at least level with the surrounding parts. Complete sterilization of the wound is aimed at but we have been unable to accomplish it in all cases especially in lesions of great chronicity. These surfaces are roughly tested by discontinuing the antiseptic and covering the surface with dry gauze for 24 hours when observation of the amount and character of the exudate gives an idea of what will occur when the graft is applied. This test is also advocated by McWilliams (6). In the case of granulating areas of this type in which sterilization cannot be effected an excision of the entire area is done if possible. If the excision can be done in an aseptic manner leaving a clean base grafts are applied directly to this base. If however there is doubt on this point the base is resubjected to treatment with Dakin's solution and the graft

applied later when the surface is satisfactory. There is no doubt but that grafts will take in the presence of sepsis but the percentage of successful takes is much smaller and sterility of the wound is worth striving for.

After many attempts at using isografts we are convinced of their futility and always use autografts. A rather extended trial of isografts using donors with compatible blood groups gave results in our hands uniformly ultimately bad. The reaction of the isografts were similar to those described by Holman (5) either a sudden reaction causing an immediate disappearance of the graft or an apparent take followed in several weeks by a loss of the graft by disintegration. In one case large granulating areas on the anterior aspect of both thighs were grafted with skin from a donor with a similar blood group and an apparently perfect take secured the area having a living



Fig 2 (1 ft) Patient with graft on gutta percha strip attached

covering for 7 weeks when the entire grafted skin literally melted away in a day leaving a granulating surface as before except for some diminution in size due to growth from the periphery. Grafts are taken whenever possible from the right thigh of the patient each graft being cut as large as the area to be covered if possible otherwise the grafts are cut so as to cover the surface with as few grafts as possible. Prior to cutting the graft the skin is either moistened with normal saline solution or lightly greased with a thin petrolatum as suggested by Parker (4). A large broad bladed amputation knife has been satisfactory for cutting the graft (Fig 1). The graft is left attached at one end and dropped back in its bed being easily smoothed out by a stroke with the back of the knife blade and a piece of gutta percha laid over it. The outer aspect of the graft adheres to the gutta percha strip which is now picked up carrying the graft with it and the attached end of the graft is severed (Fig 2). This can be floated in normal saline solution skin side up if it is desired to cut other grafts.

The grafts are now applied to the surface to be covered. If it is a granulating surface it has been



Fig 3 Graft placed in position gutta percha strip removed

previously prepared as described and nothing further is done to it at this time. If it is a fresh surface of fat fascia or muscle perfect hemostasis is secured. Rather than risk a graft on a surface with doubtful hemostasis we have resorted to the expedient of applying a pressure dressing of dry gauze to the wound and placing our saline solution keeping the grafts in the ice box. At the end of 6 hours the dressing is removed when all oozing has stopped and the grafts are applied as usual. The grafts can be cut any desired shape as they lie on the gutta percha (Douglas 3) and are placed wherever desired. Pressure is made on the graft through the gutta percha and the gutta percha is removed (Fig 3). Any air or liquid bubbles present are now pressed out by gentle manipulation with a probe. Other segments of skin are placed in a like manner so as to overlap at their point of junction and also to overlap the margins of the wound. The grafts now in position are carefully dried of all gross moisture with cotton applicators.



Fig 4 (left) Graft in position covered with paraffin. The graft are shown separated but should be slightly overlapped.

Fig 5 Paraffin-covered grafts held with gutta serena strips ready for final gauze dressing.

Flexible paraffin of the type used in the treatment of burns is applied as a spray by means of the paraffin atomizer. The paraffin is maintained at a constant temperature just above the melting point of the wax in a water bath (Fig 4). Care is taken not to hold the atomizer too close to the graft—a distance of at least 12 inches is usually correct. The entire grafted area and a margin of normal skin at its periphery is covered with a layer of paraffin at least 1.5 millimeters in thickness. The grafts are thus firmly anchored and their displacement by subsequent manipulations

is unlikely. The entire paraffined area is covered with strips of gutta serena each about 2.5 centimeters wide and 7 long as the wound. The strips are laid with an overlap (Fig 5). Over this is placed a dressing of fluffy gauze sufficient in amount so that the pressure exerted by the bandage or adhesive applied over it will have an elastic quality. A moderate even pressure of this nature can be safely applied since the grafts are anchored by the paraffin and we regard this pressure as highly important in securing good results. The principle of pressure as applied

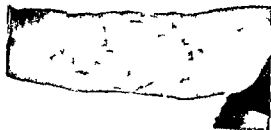


Fig 6 Olethrich graft flaps on leg of girl with long ulcer. Four weeks after grafting.



Fig 7 Large anastomotic leg with traumatic ulcer. Burn 6 years ago.

the dressing of free full thickness grafts has been emphasized by Blair (1) and McWilliams (6) and seems to us worthy of use in the management of the thinner graft

After the retention bandage is applied the part if an extremity is splinted to secure further security for the graft. After the grafted area is covered with its coat of paraffin a similar coating of paraffin is applied to the area from which the grafts have been removed. Over this a gauze dressing is applied and the whole covered by a bandage. This has proved to be a most comfortable covering for this at times uncomfortable area.

The time of the first dressing after operation will of necessity vary somewhat with one's conception of the degree of infection present. In grafts applied to a sterile fresh surface the dressing need not be taken down for 5 days at least but when dealing with a granulating surface we are in the habit of doing the first postoperative dressing on the third day. At this time the sheet of paraffin can be lifted from the grafts without in the least disturbing them. The amount of moisture present varies. If the surface is sterile the grafts are dry, pink and firmly fixed. If infection is present there will be some exudate present varying in amount and character with this factor. The amount of exudate however is always smaller in amount than one might expect. If the surface is dry and sterile a dressing similar to the primary one is now reapplied and the subsequent dressings done every second day. If any infection is believed to be present the wound is carefully cleaned with cotton pledgets moistened with Dakin's solution then dried and exposed to the air under a screen or bed cradle. The further use of paraffin is discontinued in this group of cases and they are exposed to the air during the day with careful cleansing twice each day. At night they are dressed with sterile petrolatum around the periphery of each graft and covered



Fig 8 Same patient as in Figure 7 following excision and grafting. The enormous surface to be covered necessitated leaving space between grafts. A useful leg 2 years after grafting.

with gauze and bandage. In the uncommon case with profuse exudation and marked sepsis moist dressings of Dakin's solution are used during the night. After the lapse of 3 days there should be enough fixation of the grafts so that further splinting against displacement should not be necessary.

The chief argument against the use of paraffin is that it seals the wound causing a retention of secretion which will elevate the graft. We have not found this to be true so much as is the case when other impervious substances are used. We regard paraffin as valuable because (1) it fixes the graft at a time when a slip means disaster (2) its splinting effect insures the application of a correct amount of pressure without danger of displacing the graft and (3) when the time for its removal comes the paraffin comes away freely without any tendency to stick and loosen the graft. All of these are factors important to secure a successful outcome.

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OIL STERILIZATION OF EDGED INSTRUMENTS<sup>1</sup>

By FRANK H. LAHEY, M.D., F.A.C.S. AND ROBERT L. MASON, M.D. BOSTON, MASSACHUSETTS

THE unsoundness of the method of sterilizing edged instruments by immersion in alcohol is shown by two recent reports demonstrating the presence of the bacillus aerogenes capsulatus in active state upon such instruments even after they had been supposedly sterilized in alcohol solution.

In one instance reported by Fritz Brunning<sup>2</sup> 2 patients were operated upon with instruments used in a case of gas bacillus infection some days before. Both these patients developed gas bacillus infection and the presence of the organism upon the instruments employed was demonstrated by bacteriological examination. These instruments had been washed with hot soap suds after being used, dried and placed in 70 per cent alcohol.

In the other case reported by R. N. Nye and T. B. Mallory gas bacilli were discovered upon a knife blade removed directly from the instrument cabinet and placed in deep tubes of bouillon. The writers then undertook the following experiment in order to determine the effect of the operating room sterilizing solution (70 per cent alcohol) on a gas producing sporulating anaerobe. Six 6 inch pieces of fairly heavy wire (about 18 gauge) were inserted in an anaerobic plain bouillon culture of the gas producing sporulating anaerobe obtained from a Bard Parker knife blade. The wires were withdrawn, placed in a large sterile test tube and incubated at 37.5 degrees C until dry. Five of them were then placed in individual sterile test tubes containing the operating room sterilizing solution and allowed to remain for 5, 10, 15, 30 and 60 minutes respectively. The five wires as well as the sixth untreated wire which served as a control were then cultured anaerobically in plain bouillon. All of them showed abundant growth and gas after 24 hours incubation at 37.5 degrees C. The observers concluded therefore that one and possibly two of the fatal gas bacilli cases were due to infection at the time of operation from knife blades or scissors used 2 or 3 days earlier on a known case of gas bacillus infection and inadequately sterilized prior to re-use.

In view of these findings it became obvious that a more reliable method of sterilizing edged instruments must be employed than that of alcohol immersion. Many clinics tried to meet the difficulty by boiling the instruments in water. But while boiling in water insures sterilization

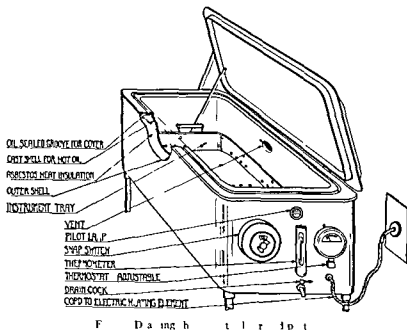
it destroys the delicate edges of the instruments particularly of knives which is so important for sharp accurate dissection. That an efficient and more desirable degree of sterilization may be obtained without loss of the delicate edge was demonstrated by Henry Lyman<sup>3</sup> of Boston.

The superiority of the oil sterilization method is demonstrated here in the accompanying photomicrographic illustrations showing the edges of instruments sterilized for varying periods of time in water, in alcohol and in oil.

We wish also to present the plan of a compact and convenient sterilizer designed for the New England Deaconess and the New England Baptist Hospitals by Leo G. Pelkus, Boston, Massachusetts.

The sterilizer consists of a cast aluminum shell or box with rounded corners and an outer shell of heavy polished nickel copper. The inner shell is the oil container. In the space between the two shells is a 1/4 inch thickness of asbestos heat insulator which effects a great economy of heat and also keeps the exterior of the sterilizer cool. A cast hinged cover is fitted to the machine which when closed drops down into an oil sealed groove thus effectively preventing any escape of odor or of fumes except through the special vent hole provided in the back of the sterilizer. This vent is piped to the atmosphere or it may be fitted with a new type of ejector vent valve designed to withdraw any hot oil vapor. The sterilizer is fitted with a perforated tray having non heat conductor handle which can be raised or lowered simultaneously with the cover by means of a hand lever mounted on the side.

The sterilizer is heated by thoroughly insulated Cutler Hammer heaters securely bolted to the bottom of the cast aluminum container. The best temperature for sterilization is 150 to 160 degrees C and the wattage of the heaters is sufficient to bring the oil up to this point in not more than 30 minutes. The temperature of the oil is then thermostatically maintained at the point required for sterilization by an improved type of adjustable thermostat. This thermostat may if desired be set to control any sterilization temperature ranging from 100 to 160 degrees C within one degree of the setting. Further accessories to the sterilizer include a snap switch, a pilot lamp, a drain cock



F<sub>1</sub> Ma hed ph t p h s f k i f t ated (l ft) nd f t r d 3 m utes a bol ter

F<sub>3</sub> M on hed ph t raph f k n f u t ted (l ft) d ft nd 3 m utes ope ntal hol

F<sub>4</sub> M fed ph t graphs f k f tre t d (l ft) d ft o o l 30 m utes n lat 150 d grees C

and a mounted thermostat which serves as a check on the temperature

By this thermostatically controlling the temperature of a highly purified mineral oil in a heat insulated container it is possible to effect a great saving of heat. It is also possible to effect positive sterilization at a known predetermined constant

temperature without any injury whatever to knife edges or needle points in a surprisingly short time. A working diagram of the sterilizer is shown (Fig. 1).

For the past year we have sterilized our edged instruments in an oil sterilizer as described above. Liquid petrolatum is used since this oil gives off

practically no odor when heated and by virtue of its high flash point is not easily inflammable. Knives, scissors and needles are sterilized at a temperature of 150 degrees C for 10 minutes.

Aside from the assurance that one is using an absolutely sterile knife, further satisfaction arises from the use of the oil sterilizer in that the cutting edge is unchanged by the sterilization. We have for some time observed in dissection the difference in the cutting edge of knives boiled in water and those sterilized in oil. To ascertain if an actual change occurred in the knife edge after boiling in water, we took photomicrographs of the edges of three knife blades. One of the knife blades was then placed in boiling water for 10 minutes, one in oil at 150 degrees C for 10 minutes and the other in 70 per cent alcohol for 10 minutes. Photomicrographs were then taken of the edges and again after 20 and 30 minutes treatment in boiling water, oil at 150 degrees C and 70 per cent alcohol. In this way a series of photomicro-

graphs were secured showing the effect on a knife blade of immersion in boiling water for 10, 20 and 30 minutes and a similar series showing the effect of oil sterilization and immersion in alcohol for similar periods of time.

These photomicrographs are shown in the accompanying cuts.

The destructive effect of the boiling water is clearly shown. The edges sterilized in oil show practically no change. Those sterilized in alcohol show a number of fine serrations which might effect the edge somewhat, but these cannot be compared with the deep notching produced by the boiling water.

#### CONCLUSIONS

1. Sterilization of edged instruments by immersion in alcohol has been proved unsound.
2. Sterilization in boiling water is effective but destroys the cutting edge.
3. Oil sterilization is effective and does not destroy the cutting edge.

## EDITORIALS

### SURGERY GYNECOLOGY AND OBSTETRICS

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AUGUST 192

#### 'SILENT' INFECTIONS OF THE KIDNEY

THE autopsy table not only corrects many erroneous impressions but at times gives the clinician an awful jolt. It is astounding how frequently unsuspected kidney infections are found by the pathologist infections which gave few, if any, symptoms. It is most fortunate for our patients that most kidney infections produce such definite symptoms that they may be easily recognized by a well trained physician. Often enough, however, the local symptoms are so slight or negligible that a diagnosis of renal involvement can be reached only by exclusion.

In cases in which for one reason or another ureter catheterization can not be employed (for instance when the bladder is open) the clinician is liable to be in a quandary. He may however be in the same position even when he can avail himself of all the newer diagnostic aid and may fail to recognize a serious, perhaps a fatal lesion that involves the kidney cortex and does not communicate freely with the excretory channel.

It is highly probable that the peculiar lack of local (focal) symptoms is due to the fact

that the causative agent is of attenuated virulence. In the cases that I have studied the staphylococcus aureus and the colon bacillus have been the most frequent causative organisms. From my experience there seem to be many cases of colon bacillus pyelonephritis with multiple foci of suppuration in the kidney parenchyma in which pain and local sensitivity are very slight or completely absent. When ureter catheterization is feasible unilateral or bilateral pyuria clarifies the picture and the absence of local symptoms may fail to make a deep impression. If however such ureteral exploration is impossible the cause of a mild or severe systemic reaction may remain in doubt as is often the case in patients whose bladders are draining. On the other hand when the infection is limited to the kidney cortex as in staphylococcus infections when the urine is normal when the most careful functional studies and pyelographic work show nothing abnormal and when there are no local symptoms the diagnostician is perplexed and must bear in mind the possibility of a silent infection of one or both kidneys.

Whether it will be possible to recognize such silent infections by newer methods of diagnosis including activation of the focus by vaccination further study will have to show. From experience in several cases of bilateral staphylococcus infection of the kidneys I believe activation by vaccination with stock vaccines may be of some use. In these cases of bilateral kidney infections the primary suppurative process, e.g. boils, had antedated the local symptoms by many weeks and at the time of the operation on the one kidney there was no suspicion of trouble in the second



organ Within 10 to 12 days after operation symptoms referable to the second kidney developed and at operation perinephritis was found with purulent foci and cortical kidney suppuration identical with what had been encountered in the first kidney operation. The lesions on both sides corresponded so that one was forced to the conclusion that both kidneys had been infected simultaneously weeks or months before the first operation and that the second kidney infection had been silent until activated by the wound absorption following the trauma of the first operation.

Up to date our experience in attempting to activate with vaccines silent foci in the kidney is very limited. Positive results in cortical infections seem to have been obtained. Further experience is necessary before certainty is established. Whether we can get similar activation in the colon group of infections with vaccination is uncertain. It should be kept in mind as a possible aid in clarifying a difficult clinical picture.

In brief it may prove possible to activate silent kidney infections by producing a focal reaction and thus the infection may be made vocal.

EDWIN BEER

### ABDOMINAL ADHESIONS

UNTIL quite recently it was common practice for a surgeon to operate for adhesions even though the symptoms did not point to any very definite pathological process, often the chief excuse being a history of vague symptoms following a laparotomy, especially if the patient's discomfort developed about the site of the operation.

There was too great a tendency to connect the symptoms newly acquired with the former surgery. The patient was promptly told that adhesions had formed and the only hope of relief was in another operation. Unfortunately only too often these patients again dis-

appointed would return to the surgeon a few months later with the same symptoms perhaps in a more acute form. A few experiences of this kind suffice to make the observing and conscientious surgeon become wary of too hastily opening the abdomen on a vague diagnosis of adhesions. Not only will he make a most careful examination using all possible aids to make as definite a diagnosis as is humanly possible but he will also look very carefully into the history of the patient given prior to the primary operation. It is of the utmost importance to know whether the symptoms that developed after the primary operation are identical with those given formerly and whether the first operation has really accomplished the results intended.

The use of the X ray (with bismuth meal) has been a great help in the study of such abdominal cases and no doubt it has prevented a good many unnecessary operations.

When all other conditions are eliminated and adhesions appear to be the only cause of the symptoms the problem is not necessarily solved. It is surprising how few of these patients can be cured by just another operation. We all have seen patients return with more aggravated symptoms pointing to greater masses of adhesion than there were before the operation.

However there are certain types of adhesions that are amenable to surgery. Undoubtedly the technique of the surgeon plays a very important part. Careful excising of one or more offending bands may give complete relief. When their reformation cannot be reasonably guarded against the secondary operation may consist of a procedure in which the adhesions *per se* are not disturbed at all but relief is sought through other channels. For instance when massive adhesions are found about the gall bladder fossa following cholecystectomy involving the duodenum

in such a way as to cause almost complete destruction of the enterostomy may be the operation of chance. When the enterostomy colon is found fully contracted, in the agone, last may give better results and adhesions are left alone.

One of the problems that present itself to us is how we can do our work so that there is only a minimum risk of postoperative adhesion. First of all the uterus should be handled a little and a gently a possible. We should exercise great care in checking them rather all raw surfaces should be pentonealized or covered with mentum or fat. In using hot packs we should be careful that they are not too hot a too much heat applied to the uterus naturally promotes adhesions. Last

but not least we should be surgically clean as infection is a very fruitful cause for adhesions. While literature abounds with suggestions of various foreign material to cover over the naked area such as non absorbable membranes and lubricant thus far their usage has not been justified.

It is an interesting fact that some patients have a tendency to form very extensive adhesions on very light provocation and there is no way of forecasting this tendency. If it were possible to determine this fact it would often be wiser to let them suffer from the disease they have rather than disable them by an operation which might ultimately result in serious postoperative adhesion.

O. F. LAW, JR.

# MASTER SURGEONS OF AMERICA

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## WRIGHT POST

**W**RIGHT POST was born February 18 1766 at North Hempstead on Long Island and died at Throggs Neck the Bronx June 14 1828 His father was Jotham Post and his mother was a daughter of Benjamin Wright For nearly thirty years he was the leading practitioner in New York City

At the early age of fifteen he began the study of medicine under Richard Bayley a skillful and celebrated surgeon of New York After four years of diligent and persevering work at home he went to London to become pupil to John Sheldon renowned teacher of anatomy and surgery In two and one half years living most of this time with his preceptor he undoubtedly absorbed much of the spirit and zeal of this great enthusiast

On his return he began active practice and was soon delivering lectures in anatomy at the New York Hospital The e were interrupted however by the occurrence of what was called by the chroniclers of the day the Doctors Mob The reason for this demonstration was about as follows During the preceding winter some local cemeteries had been invaded graves opened and bodies removed therefrom The people were greatly outraged They suspected doctors of using this means of acquiring dissecting material On Sunday April 13 1788 children playing in the hospital yard saw a limb hanging out of a window They told others and a crowd collected entered the hospital removed a couple of bodies which were later interred destroyed some valuable specimens and even sought the young doctors several of whom the mayor and sheriff rescued by lodging in jail The next morning a number of people gathered searched the homes of the suspected physicians but as they were not satisfied in the afternoon they threatened the jail The militia had to be called out As they responded in small groups one being surrounded and stoned fired in self defense killing two or three and wounding others The mob disbanded shortly after

In 1790 Post married Dr Bayley's daughter and the following year became associated in practice with his father in law He was appointed professor of surgery in Columbia College in 1792 while Dr Bayley was given the chair of anatomy He then went to London again for further study and to procure a medical cabinet Returning in 1793 he brought back the material for the first museum according to John Augustine Smith in the United States



WRIGHT POST  
1,66-18 8

nethy and Cooper was thought to be a complete answer to the taunting question What have your American physicians and surgeons ever accomplished?

A relative has said of Post as a boy that he was 'remarkably quiet amiable and accommodating but resolute and firm in his purposes and active both mentally and bodily. He was never known to engage in mischievous sports or dangerous intrigues and his mother was heard to say his conduct never afforded her uneasiness. As a man he was tall handsome dressed stylishly and wore his hair powdered and in a queue. He had not the time and maybe not the inclination for great attainments in the arts literature or science. He read little was verse to writing and was not brilliant in speaking. His lectures however were delivered calmly and with crisp clearness such as is often lacking in those who are perhaps confused by the complexities of greater learning or more imagination.

Many thought him inwardly cold but on occasions he showed deep concern and the greatest tenderness. John Augustine Smith in speaking of his position at the head of his profession says. To acquire and maintain that station two things are necessary—the confidence of the public and the good opinion of the faculty. To obtain the former mere ability will in a great degree suffice but to secure the latter something more is required. virtue must be superadded. a flaw in the heart being here is fatal as a defect in the head. But so unlimited was the confidence of every practitioner in the city in the honesty of Post that no patient could be more anxious to receive the benefit of his advice than the attending physician was ready to meet him in consultation. The public appreciated his talent and the profession relied on his virtues. And what renders Dr. Post's character in this respect the more praiseworthy is that while perfectly correct himself he well knew how to rebuke and to punish any medical man who should infringe with regard to him those rules of good conduct and gentility which should regulate medical intercourse. He thinks we may deduce two useful lessons from Post's life. First that Fortune is not so capricious in her favors as many imagine and second to secure those favors in other words to attain the success of Dr. Post we must first acquire his skill and tact and what is perhaps more difficult certainly more rare we must practice these qualities with his steadiness and virtue.

ALFRED STILLMAN

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD MARCH 20 1925 DR CAREY CULBERTSON PRESIDING

### UTERUS FROM A WOMAN DYING OF SEPSIS AND HEMORRHAGE FROM A TEAR OF THE CERVIX

DR W B SERBIN, pathologist of the Chicago Lying In Hospital. The specimen presented is a uterus from a woman dying of sepsis and hemorrhage from a tear of the cervix. Mrs M, age 36 years, para 7, received at the Chicago Lying In Hospital almost in extremis. The history was contradictory, the first statement being of a version performed for prolapse of the arm, the second—by a sister who was present—that of a breech extraction. It seems certain that the woman had had little or no uterine action previous to operation. During the procedure which was done at home without an anesthetic the woman complained of great pain and went into shock. The delivery was followed by a profuse hemorrhage. The child lived.

On the fifth day the patient again bled profusely, the uterus was packed and patient rallied. The packing was removed the next day. The temperature had risen steadily after delivery and when the visiting nurse discovered the family, the patient was in an advanced state of anemia and infection. After admission to the hospital the usual restorative measures did not improve her condition. This steadily grew worse although there was no further hemorrhage. The temperature was 103 degrees F, pulse 136, red blood corpuscles 1,730,000, white blood corpuscles 17,000, her appearance was ghastly and subicteric. There were no signs or symptoms of peritonitis or pneumonia but the liver dulness was increased. A transfusion of 550 cubic centimeters of her brother's blood was made, the blood of the two having been first carefully matched. This was followed by an attack of cyanosis, dyspnea and increased rapidity of the pulse. Shortly after this happened over the patient began to bleed from the vagina and an hour after this appeared there was a profuse flow.

Examination showed that there was a cervical tear on the left side and that the hemorrhage came from an opening near the outer lip of the tear. It was clamped with a vulsellum and the uterus packed but the woman died from hemorrhage on the table.

The autopsy confirmed the diagnosis of general puerperal septicemia. There was visible on the specimen herewith presented the positive evidences of a septic endometritis with superficial gangrene of the

endometrium especially marked at the placental site. The infection is mainly lymphatic and the broad ligaments as well as the pelvic connective tissues are inflamed and infiltrated. There is a beginning pelvic peritonitis over the areas of pelvic cellulitis. The spleen was soft almost fluid, the liver enlarged, yellowish white—likewise septic. Of special interest is the course of the hemorrhage. There is a deep cervical tear on the left side extending almost into the broad ligament. The sinuses of the cervix and lower uterine segment are unusually well developed and in the base of the ulcerated area one could see when the specimen was first cut open the openings of the sinuses filled with soft blood clots. These sinuses can still be seen. About 1 centimeter from the external orifice of the uterus as large as a goose quill is visible which was the source of the fatal hemorrhage. It is from this spot that the bleeding was seen to be the worst.

### UTERINE FIBROID WITH A SECOND LARGE FIBROID GROWTH ATTACHED BY A PEDICLE TO THE PERITONEAL SURFACE BETWEEN THE LEFT TUBE AND ROUND LIGAMENT PAPILLARY DEVELOPMENT APPEARING ON THE PERITONEAL SURFACE OF THE TUBE AND OVARY

DR CAREY CULBERTSON. The patient in the first case was a negress 25 years of age. She had complained of pain in the lower abdomen for 3 weeks. The onset was sudden while she was at work and increased in severity until she had to go to bed. The pains were cramping in character and she vomited at times during the first 2 weeks of the illness. She then noticed a lump or swelling in the left lower abdomen. Her menses occurred first at 16 years of age every 15 days, duration 7 to 8 days, regular and profuse so that she bled about half the time. She had never been pregnant. She was poorly developed and somewhat emaciated woman with a temperature of 100 degrees F upon entrance to the ward (February 27, 1925). Her abdomen was thin walled and distended in the left lower quadrant by a hard irregular mass above the pelvis free but tender when moved. Centrally situated was another large hard mass plainly within the pelvis. Voluntary rigidity was elicited on both sides on palpation.

On a final examination the cervix is normal but the corpus was upright enlarged and continuous with the mass in the central portion of the pelvis and apparently not connected with the higher left mass except by a pedicle. The right pelvis was empty. Leucocytosis was 11,600, haemoglobin 60 per cent. At operation there was found occupying the upper left pelvis and lower abdomen a large firm fibroid growth attached by a pedicle to the outer surface of the left broad ligament between the round ligament and tube. The growth was 12 centimeters was free and its pedicle a narrow flat one not twisted. The central mass was a multinodular uterine fibroma.

According to Seaver it has recently reported a case of this sort with twisted pedicle. These infrequent fibroid growths are not common. The first case was reported by Burnham in 1867. Scam in 1893 coll. etc. 12 cases in the literature. In 1900 12 cases were reported in the American literature while in 1906 Doran reported 132 cases in the English literature. Two other cases were reported by McNeil and Hamilton and 2 or 3 others were cited without description.

This tumor occurs most frequently within the broad ligament and close to the uterus. Most of the foreign cases and all the early American ones were of this type. It rarely occurs in outer portions of the broad ligament. Only about 12 cases were pedunculated. It is always unilateral. Some growths have weighed to 40 pounds.

In my case no other cause than the growth described could be found to occasion the symptoms complained of by the patient. It is of interest to ask if these symptoms so suggestive of twisted pedicle may not have been caused by the tumor hanging become twisted and later straightened out.

The second specimen was a papillary growth on the peritoneal surface of the tube and ovary and was taken from a negro 45 years of age who entered the hospital complaining of a sharp aching pain in the lower abdomen of several duration. A swelling of the lower abdomen had been noticed for some length of time and this was thought to be increasing. For 2 months she had a poor appetite and a moderate loss of weight. The pain had been so severe recently as to cause her to get to bed. She had given birth to children 26 and 22 years ago respectively. Her menopause occurred in 1924. There have been no periods since last September.

She was a thin undernourished woman with a moderate degree of hypertension, normal temperature, urine and leucocytosis haemoglobin 60 per cent. The abdomen was soft flaccid distended and firm. The lower umbilicus because of a large round firm mass rising from the pelvis and projecting prominently forward. The vagina was hypertrophied and cervix forward behind the symphysis and the pelvis occupied by a large firm mass. The lower portion of which was cystic.

The specimen shown represents a uterus enlarged by fibroid growth 6 centimeters in diameter which shows gray degeneration with one small subserous

growth attached. The uterine cavity is 8 centimeters deep with normal mucosa. The right ovary is represented by a pseudomucinous unilocular cyst 2.5 centimeters in diameter its contents cast a faint color. There are two flattened papillary growths on its outer surface and one small development of the same type on its inner surface. The right tube is adherent about the circumference of the cyst. The left ovary is a cystic mass apparently a simple cystic degeneration of follicular 6 centimeters in diameter with the tube thickened and closed and adherent to it. Attached to the peritoneal surface of this left appendage by pedicles are several groups of papillae each the size of a bunch of currants. This appendage with it attached papillae was free from any adhesions.

The microscopic sections showed all of these papillary growths to be typical papillary cystadenomatous normal gland.

### ENCEPHALUS A CAUSE OF EXTREME DYSTOCIA

DR W. A. NEWMAN DORLAND presented a paper entitled Encephalus a Cause of Extreme Dystocia (see p. 180).

#### DISCUSSION

(FRED W. BARTLEMEY, Ph.D. (University of Chicago)) All that I can contribute to this discussion is to say something about possible causes of monsters such as these. It may seem a far cry from flat worms to human monsters but the general conclusion reached by Child from his experiments on these and other impossibly large animals provides us with the best working hypothesis of the origin of such abnormalities in development as may be caused by the immediate environment of the embryo. I have been hoping that certain poisons and all anesthetics act in the same general way inhibiting development as well as reproductive processes. The specific result of time is due to the time at which the contact influences act their duration and their intensity. According to Child's theory of gradients the regions of an embryo which are most active at an given time not only dominate neighboring regions but are most susceptible to injury.

The majority of monsters have defects of the nervous system and those which can be explained by a failure of the neural folds to close must be referred to the end of the third and the fourth week of development. We have now a sufficiently close series of anencephalic monsters and spinal basilar cysts that in these cases everything develops normally except that the brain ventricles or the central canal remain in communication with the amniotic cavity. The degeneration of the central nervous system due to malnutrition in the liquor amni. The skeletal defects I think are secondary to the fact that the lining of the central nervous system has remained in continuity with the outer skin. In the case of anencephalic monsters the neural defects may easily

be explained as failures of the neural fold to close and the characteristic structure may have been present in neural fold stages.

The purely mechanical explanations of defects such as the presence of amniotic adhesions and bands are gradually being shown to be untenable. They are secondary rather than causal in my opinion.

DR HENRY F. LEWIS. I have two or three slides to show which illustrate cases of meningocele that I have had.

As Professor Bartelmez says the original conditions are not shown in these late cases and we can only show the final stages. Most of these pictures were taken before we knew much about the X-ray. One case of meningocele shown in these slides occurred in the Cook County Hospital some 3 or 4 years ago but we did not have a chance to X-ray it. Some of these pictures were taken from specimens in the museums of Rush and Northwestern Universities. Two slides are from pictures of a case of my own the mounted skeleton of which is in the Rush collection.

#### ETIOLOGY OF PRE-ECLAMPTIC TOXÆMIA FROM A CLINICAL ASPECT

DR EUGENE CARY discussed the subject of pre-eclamptic toxæmia from a clinical aspect (see p. 194).

#### DISCUSSION

DR C. S. BACON. I think that this paper represents a great deal of work. It has not however solved the question of the cause of eclampsia and the author did not claim to. The longer it goes and the more attempts we make to dig into the cause of eclampsia the more discouraged we get. I remember how encouraged we all were along in 1890 when Schmorl and Voit discovered that emboli from the placenta would explain the production of eclampsia. We were encouraged the same way that others were encouraged some years before when it was discovered that the kidneys and albumin in the urine could explain eclampsia. From that time on we got more and more discouraged because these theories did not explain eclampsia. The work is well worth looking today but it is particularly encouraging to me that the author would take such an eclectic view of the subject and conclude that the one important fact is diet. I believe that is what most of us would believe—that the by-products from the diet have a great deal to do with the production of toxæmia and eclampsia. That being the case the method proposed is very desirable.

DR HILLIS. Dr Cary is to be congratulated on the discovery of eclampsia in his clinic. The number of theories advanced regarding the cause of eclampsia indicate how little we know about it. We naturally turn to the laboratory for a solution of the problem but it seems we have learned about as much from clinical experience as we have from the laboratory.

These facts seem to be fairly well established at

this time (1) most eclampsia can be prevented (2) a rather large percentage of patients will die regardless of what we do for them and (3) the kidney changes are a secondary effect rather than a causative factor in the disease.

It is generally known that the diagnosis of threatened eclampsia should not depend upon albumin or casts in the urine but that rising blood pressure and appearance of the other well known symptoms are of even greater importance. The outbreak of convulsions could be more often prevented.

DR N. S. HEAFFY. I did not understand from the body of the paper whether this guinea pig that had the convulsions was injected with an eclamptic placenta or the placenta of a normal woman.

I understood that in the analysis of these 1000 cases there were 54 cases of hyperacidity of the urine. I am wondering if Dr Cary makes a practice of titrating the urine for acidity and if so if he notices any other phenomena regarding the hyperacidity in the analysis of the cases.

DR T. J. DOEDERLEIN. During my sojourn in the Orient I saw many cases of eclampsia. I was stationed in a remote very poor country district where people lived almost exclusively on rice or ragi. If carbohydrate diet changes the intestinal flora so that putrefactive conditions are not present I am at a loss to understand what agency produced these many cases of eclampsia among rice eating people. I found acute and chronic Bright's disease as a result of neglect of acute infectious diseases very common. Possibly this might be a factor. Statistics could not be compiled as only pathological cases were brought to the hospital. We probably had not a half dozen normal cases.

DR JOSEPH L. BAER. I am very much interested in Dr Cary's clinical viewpoint and in his prophylaxis which seems to have reduced the number of eclampsias almost to the vanishing point in a comparatively large series of consecutive cases. I am wondering whether in the prenatal instruction for his primipare in the late weeks of pregnancy he is indicating regular sweats. I read an article by J. D. Macht and D. S. Lubin in the *Journal of Pharmacology and Experimental Therapeutics* January, 1914 which was one of the most beautiful pieces of research work I ever had the pleasure of reading. It had to do with the determination of the existence of a menstrual toxicity. For ages it has been known that menstruating women who attempted to knead dough inhibited the raising of the bread. Likewise in the perfume factories of France girls are barred from handling the delicate essences during the menstrual period. Other observations are mentioned indicating a very definite existence of the belief that the menstruating woman is toxic. Then the authors selected a certain vegetable form the growth of which is very rapid and very regular and with these vegetable formations in test tubes performed innumerable experiments with the co-operation of the women workers utilizing the various secretæ of these women both in the menstrual and non-menstrual periods.



demonstrating to their complete satisfaction that the sweat, the urine and the blood at the menstrual time had a very definite inhibiting effect on the growth of these spores and at the non-menstrual period had little effect. This to my mind is to a certain extent a refutation of the teaching that sweat contains nothing but water and some salts and no toxins that have a bearing on the health of the woman. It would seem to indicate fairly conclusively that toxins are eliminated in sweat and therefore to justify the clinical procedure of sweating primarily in the late weeks of pregnancy.

DR. EUGENE CARY (closing the discussion): I would like to qualify one statement regarding the toxicity of the placenta. It is toxic.

In answer to Dr. Heaney, it was a normal placenta that was used. A series of experiments have been done by which all the different tissues that could be obtained have been used. The most toxic have been lung and placenta.

Regarding Dr. Hillis's remarks, the work of Gibbons and Ter is very interesting. I am a firm believer in their work, especially as related to the vomiting of pregnancy. I have worked independently of them and they have confirmed my thought. Carbonyl hydrate feeding will contraindicate remission.

In answer to Dr. Heaney's second question, the urine was highly acid in 148 cases. I did not titrate all the urines. We do not because our clinic is too large. I have a solution of methyl red in 90 per cent alcohol which gives a very fair color index. The degrees of color vary from yellow to a Burgundy red which give us a pretty fair index as to the degree of acidity in the urine. I have never found but one case in which high blood pressure was present without hyperacidity of the urine.

From the literature I have found that the incidence of eclampsia is very rare in countries where vegetables and starches are predominant foods. In Germany during the war in one clinic there were only 2 cases of eclampsia in the year 1916 while there used to be 3 or 4 cases at all times. In these 2 cases the condition was definitely traced to the ingestion of meat.

In answer to Dr. Herwe, we advocate sweets but we do not insist upon them and the patients probably do not take them. In cases where we can check if the blood pressure goes up and hypertension develops we insist upon a sweet followed the next day by a dose of Epsom salts to promote elimination through the skin and through the intestinal tract and thereby to get the type of bacteria as we can

# CORRESPONDENCE

## THE INTERSTATE POST GRADUATE ASSEMBLY

**I**n the Interstate Post Graduate Assembly a movement has been inaugurated that will become epoch making in its results and establish a new era in the history of graduate instruction for practical physicians. It is the second stage development of a vision that at first established the fact that there was in the conduct of medical societies a need for a plan that without waste of time would give to the practitioners of medicine and surgery the real doctors an opportunity to hear the leading specialists relate their experiences in actual practice and illustrate their method by the examination of patients (surrounded by the paraphernalia of an office or a hospital examining room) on a platform in a large comfortable auditorium. Cities are chosen whose profession possessed the ability and enterprise to select describable cases and the demonstrations were made by specially invited clinicians of note and ability who were able effectively to present their subjects to an appreciative audience of earnest practitioners. These dry clinics, so called because they were only diagnostic in extent did not involve operation or treatment.

The Tri State District Medical Association of Illinois, Iowa and Wisconsin developed and executed such a plan. In five years time the sessions of this society became so popular that it was difficult for any ordinary city to accommodate its meeting.

The second stage of development began informally years ago when a group representing the Tri State Society visited the large clinical center and observed the noted practitioners and operators in their regular workshops. This new plan sounded a call that could not be resisted by practical men whose sole object was self improvement by absorbing knowledge from the actual experiences of men of broader opportunities.

Increasing numbers interested themselves in this movement. Men outside of the Tri State Society began to see the opportunity to become a part of it. Those who had already participated asked themselves why it would not be well to enlarge the scope and extend their vacations in this new type of graduate study. And the same leader was in the forefront to organize the new step in the evolution of their plan. The Interstate Post Graduate Assembly was organized its prospectus created invitations extended to members of the profession for invasion of the clinics of the British Isles, France and other European countries and in record time the demonstrations were subscribed.

These medical pilgrims, eight hundred strong, planned to profit from every hour of their vacation study. Many of them were accompanied by their wives who sought to take advantage of their husbands' sojourn in Europe to observe the things of interest usually sought by the vacation traveler. The majority of the members of the tour traveled from Montreal to Liverpool on the S. S. Doric of the White Star Line, a ship which was specially chartered and equipped to provide opportunity for the doctors to carry out prepared programs of discussion covering the range of medicine and the specialties.

In the meantime plans were in process for two years under the direction of the leading professional men in the cities included in the European itinerary, and professional and social programs were arranged. Each city had a committee on arrangements with a chairman and organizing secretary who in close cooperation with the organization head in America, Dr. William B. Peck of Freeport, Illinois, completed every detail to receive and entertain their guests.

The Interstate Post Graduate Assembly held its first formal meeting on European soil in Wigmore Hall, London, on June second, with an unusual audience of eight hundred, nearly all of whom were physicians from the United States and Canada. The inaugural ceremony was opened by the second son of King George V, H. R. H. The Duke of York, who as honorary chairman delivered a formal speech of welcome. This was followed by addresses of welcome by His Excellency, The American Ambassador, Hon. Alanson B. Houghton, The Right Hon. Nevill Chamberlain, Minister of Health, Sir Humphry Rolleston, Bt., President of the Royal College of Physicians, and Sir John Bland Sutton, President of the Royal College of Surgeons, to which an appropriate response was made by the President of the Assembly, Dr. Charles H. Mayo, The Duke of York then formally turned over the gavel to Dr. Mayo, the permanent chairman, who announced the opening of the scientific program and asked Sir Humphry Rolleston to occupy the chair. Papers were presented by Sir Humphry Rolleston, Bt., Sir William Arbuthnot Lane, Bt., Sir Thomas Morrell, Bt., and Dr. Arthur F. Hurst.

On the morning of June 2, 3, and 4 similar programs were carried out, which included such well known speakers as Mr. James Sherren, Mr. A. J. Walton, Sir St. Clair Thomson, and Lord Dawson of Lenn. The afternoons were spent at clinics and demonstrations in the medical institutions. Thirty-four hospital visits were scheduled for clinics including all of the great teaching hospitals so well known to the medical men of America.

While the real work of the Assembly judging from the attitude of this serious pilgrimage was the pursuit of scientific knowledge many private and general social entertainments were provided arranged in such a manner as least to interfere with the scientific program. Among the social events were a reception in the nature of a get together at the home of Mr and Mrs Herbert Paterson the evening of the first of June a garden party at the London Hospital the afternoon of June a reception by the Royal Society of Medicine the evening of June 3 preceded by a dinner at the home of Lord Dawson of Inn a large reception and garden party at St Bartholomew's Hospital the afternoon of June 4 many members of the Assembly were guests at the Thursday evening dinner of the famous Pilgrims presided over by H R H The Duke of Connaught and the ladies were dined on that evening by La 1 Lane a reception at Lincoln's Inn Fields by the president Sir John Bland Sutton and the Council of the Royal College of Surgeons Friday afternoon and at nine o'clock of the same evening a great subscription dinner at the famous Guildhall to Dr Mayo at which The Right Hon Neville Chamberlain Minister of Health was the chief speaker. On Saturday afternoon the American Ambassador and Mrs Houghton received all the visitors at a garden party at their home Cre House. On Saturday evening a reception was given by the American Women's Club. On the same evening the Section of Surgery of the Royal Society of Medicine under the presidency of Mr Herbert Paterson gave a complimentary dinner at the Cecil Hotel in honor of Dr Mayo and the American guests. The above program was supplemented by many private dinners at which small groups were entertained in the delightful way that Londoners have of doing these gracious things.

But while the members of the Post Graduate Assembly proved themselves normal individuals who enjoyed social functions there was a seriousness about their attendance at the scientific sessions and clinics which demonstrated that their real business was to obtain first hand information regarding the medical work of London. The symptom was apparent in Dublin at the clinics of our friends S. William I de Courcy Wheeler Sir William Taylor and Sir Robert Woods and in Belfast at the clinics of Professor Andrew Fullerton R J J Ineson and C J Lowry and Mr Thomas Sinclair Kirk.

This is a wonderful audience said Sir John Bland Sutton a well oiled crowd from the platform at the inaugural ceremony. Where do they come from? One could but properly reply that they represented the backbone of the medical profession from almost every province of Canada and every state of the United States the cream of the progress men of medicine men who know their own shortcomings and yearn to better themselves by observing the work of others. From laymen they were more and more obvious that this is a great movement

and it did not require close observation to appreciate that the hosts of the Assembly who were conscientiously furnishing scientific food to these Pilgrims were receiving as much if not more inspiration than they were giving and why not? No doubt the visit which was in prospect struck different individuals differently. Of course we will receive these visitors. But we have the teaching of our students to attend to. How can we furnish material that will be of interest? How are we going to arrange to distribute so many observers. In what are they interested? Are they general practitioners or specialists? Are they teachers in universities? How are we going to entertain them? What will the Government do? Should the Assembly be recognized by the Crown. But in all movements of this kind there is someone who knows the answer to these many questions who knows how to divide the work organize the forces and present the program in such a manner as to make the whole confusing problem a simple one. The organization of this movement was superb. The immediate after-effect upon the professional men of London was no doubt one of relief but it was easy to discern that there was a feeling of pride among those who had assumed this responsibility and even among the rank and file because of the obvious success brought forth by their efforts. The great metropolitan press had observed and published editorials which emphasized the importance of this visit of American doctors.

One great thing was apparent to the onlooker so obvious that it should not be overlooked. In the London and the large provincial cities—among them Leeds Manchester Liverpool Dublin Belfast Glasgow and Edinburgh—possess marvelous educational advantages that are not now fully utilized for undergraduate teaching. If the facilities that are going to waste were thoroughly and permanently organized as they were casually and temporarily organized for the Post Graduate Assembly they would create a comprehensive graduate school under English speaking teachers and could command students in medicine of all English speaking countries.

And the same may be said of the larger cities in the United States and Canada. Why is not this the time for the inauguration of such a movement? Has it not been demonstrated that there is an urgent demand when eight hundred practitioners of medicine have been knocking at the doors of Toronto Montreal and the cities of the British Isles praying for instruction. Have not these cities including the capital city of the English speaking world shown the ability and willingness to undertake this important work. When better than now can the graduate take his go of the world so organized as to help it with the jurisdiction of our own people?

This appreciation by a much interested onlooker would not be complete without mention of the general played by the interest of the movement. Dr William Bick who by all other was the key man and the organizer. In each of the large cities

th re were those who did unu al work but the selection of the London chairman of the British Isles Committ es Mr Philip Franklin was a mo t fortunate one And every hour of every day all were proud of the presiding officer of the Assembly Dr Charles H Mayo who was always in his place ready to lend that pre tige and steady hand and leadership that every uch movement mu t have to command respect and succe s In all seriousness he performed his task beginning with his response to the address of welcome by H R H The Duke of York and concluding at the head of a procession of three hundred patriotic citizens of America who solemnly marched down the embankment of the Thames to place wreaths upon the grave of the unknown British soldier in Westminster Abbey and immediately following on the monument to Abraham Lincoln thus symbolizing the unity of the great English speaking countries

FRANKLIN H. M. R. J.

## CARTILAGINOUS TUMORS OF BONES

A FURTHER NOTE ON A CASE OF CENTRAL  
MYXOCHONDROMA

*The Editor* My colleague Dr A H Keller published an article in SURGERY GYNECOLOGY AND OBSTETRICS on the significance of cartilage and bone tumors in the April 1925 issue Since that time the patient mentioned in Case 4 a central myo chondroma with productive osteitis returned for observation—4 years after the original operation He showed noted signs of recurrence and I operated upon him again

I feel that it is of great importance to publish a further note on this case to avoid any erroneous impressions which might arise from our report

The patient returned to our service on March 31 1925 4 years after his first operation He complained of deep seated pain in the thigh and tenderness over the scar He brought with him roentgenograms made in his home town in March 1924 and January 1925 These showed much condensation of the bone at the site of the tumor with a decrease in the total thickness of the shaft as compared with the original X ray plates and a marked increase in density The total thickness of the femur in the affected area was still greater than that of the normal femur Laterally a hiatus is present corresponding in situation with the area of peripheral bone removed at the primary operation but about one half the size of the cloaca then made The roentgenological appearance of itself did not suggest recurrence but rather a failure of the affected bone to return to normal after the removal of the tumor tissue For the past 7 months however the patient has had pain increasing in severity a frequency until recently he has had constant deep aching pain in the thigh and an area of intense tenderness over the operative scar This area corresponds in position with the hiatus in bone and is one half inch in length soft to the touch not in

flamed pressure upon it produces immediate tenderness and subsequent aching pain Contrary to the advice given him the patient had had no X ray treatment following the primary operation On account of the pain and tenderness recurrence was suspected and exploration was advised The upper one third of the medullary cavity of the shaft of the femur was filled with mucochondromatous material as in the previous instance the mucous tissue had penetrated through the hiatus and extended into soft tissue in this region only The surrounding bone showed greatly increased density and the infiltration was less extensive in its growth up and down the marrow cavity than at the primary operation Gross and microscopic examination shows initially the same characteristics as were present in the primary tumor The sclerotic bone of the hiatus is more dense than formerly and the myxomatous cells can be seen arising from the inner osteoblastic layer The tissue in the interior of the marrow cavity shows more cartilage than formerly the bulk of the tumor tissue is again mucous connective tissue (not mucoid degeneration) There are no atypical mitoses nor other evidences of malignant change The blood vessels are carried in fibrous tissue strands those capillaries which lie in the midst of the myxomatous material have endothelial and not tumor cell lining Small spicules of dead partly decalcified bone are present throughout the tumor mass no active osteogenesis is present in the interior of the tumor The character of the tissue is still histologically benign and the recurrence interpreted as the result of incomplete primary removal Under the circumstances no operation short of the excision of the entire upper end of femur could have eradicated the primary disease Undoubtedly the chance of a subsequent recurrence is great and if it occurs the tissue will probably tend toward a malignant transformation The safest procedure at this time would be amputation at the hip joint to this the patient will not consent The freedom from metastasis and the lack of histological proof of malignancy lead one to hope for a further period of freedom from clinical symptoms X ray treatment will be used in the hope of promoting further condensation in the surrounding bone as well as inhibiting the growth of such tumor cells as have been left behind

J. F. THOMPSON

## A MODIFIED MAYO UMBILICAL HERNIA

*The Editor* In an article by Dr C A Roeder of Omaha on A Modified Mayo Umbilical Hernia published in the May 1925 issue of SURGERY GYNECOLOGY AND OBSTETRICS I note that his description of the operation is practically the same as that given by me under the title Cosmetic Operation for Umbilical Hernia in the October 1923 issue of the *Surgical Clinics of North America* Unquestionably Dr Roeder and I arrived independently at our conclusion but I thought your readers would like to know of the earlier publication

R. F. FARR



# MEDICI ANTIQVI

OMNES, QVI LATINIS LI-

TERIS DIVERSORVM MORBORVM

genera & remedia persecuti sunt, undique con-

quisiti, & uno volumine comprehensi,

ut eorum qui se medicinæ studio de-

diderunt commodo consulatur

*Index in omnes plenissimus*



V E N E T I I S, M D X L V I I









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## PRELIMINARY PROGRAM FOR PHILADELPHIA MEETING

THE program for the fifteenth annual session of the Clinical Congress of the American College of Surgeons to be held in Philadelphia October 26 to 30 as published in the following pages is merely an outline of the program being prepared by the Committee on Arrangements. During the coming months the program is to be revised and greatly amplified under the supervision of the Committee on Arrangements so that the final program will represent completely the clinical activities in all departments of surgery in that great medical center.

An important feature of the program will be a series of demonstrations or dry clinics at the larger hospitals in which the surgeons internists pathologists roentgenologists and other specialists will participate to discuss some of the more important phases of surgery.

Another series of clinical demonstrations dealing with surgical aspects of ophthalmology otology rhinology and laryngology will be

given each forenoon in the Ballroom of the Bellevue Stratford to supplement the clinical work in the hospitals in the afternoons. Thus a full program of clinical work will be provided for each of the four days of the session for those who are interested in surgery of the eye ear nose and throat.

General headquarters of the Congress will be established at the Bellevue Stratford Hotel Broad and Walnut Streets where the entire first floor including the Ballroom Clover Room Rose Room Gold Room together with the Stratford Room on the main floor and the Rose Garden and other rooms on the roof have been reserved for the exclusive use of the Congress. These rooms provide ample space for evening meetings business sessions hospital standardization headquarters registration and ticket bureaus bulletin rooms etc.

A number of fine large hotels situated within easy walking distance of the Bellevue Stratford

have been erected since the last meeting in 1917 so that the hotel situation in Philadelphia has been greatly improved. See list of hotels with their rates on another page.

An application for reduced railway fares on account of the meeting in Philadelphia is pending with the railway passenger stations and it seems as well that a substantial reduction in fares will be granted applying to all sections of the United States and Canada.

#### MEETING MEETING

Monday—Ballroom—Presidential meeting in inaugural address by Dr. E. L. H. Mays of New Orleans. J. H. B. Murphy, Oration in Surgery. Tuesday—Ballroom—Scientific papers and discussion in general surgery etc.

Rose Carlen—Scientific papers section in surgery of the eye, ear, nose and throat. Wednesday—Ballroom—Scientific papers and discussion in general surgery etc.

Rose Carlen—Scientific papers section in surgery of the eye, ear, nose and throat. Thursday—Ballroom—Scientific papers and discussion in general surgery etc.

Rose Carlen—Scientific papers section in surgery of the eye, ear, nose and throat. Friday—Ballroom—Thirteenth anniversary of the American College of Surgeons. Tell a story. Address.

#### HOSPITAL CONFERENCE

An interesting and instructive program has been prepared for the hospital conference during the first two days of the Conference. The program consists of addresses, papers, and discussion dealing with the various aspects of hospital work as related to the hospital standardization movement. The chief participants interested to surgeons, hospital trustees, executive, and personnel generally.

The tentative program for the conference includes the following: Eighth annual report on hospital standardization with a list of hospitals meeting the minimum requirements of the College of Surgeons. A report on the hospital standardization of the hospital the doctor and the nurse as co-operative factors in the care of the patient. The eminent hospital officials of the College standard in the modern hospital the hospital of the future what the College can do for the small hospital. Postmortems in hospitals—findings in the State of Pennsylvania survey. Relation of the surgeon to postmortems postmortems in the open hospital and results and

follow up essentials for an efficient fracture service. Collection and publication of medical statistics.

Two round table conferences are proposed for conducted by Dr. Joseph C. Dixon, medical director and superintendent of the Philadelphia General Hospital and Dr. John D. Sperman, superintendent of the T. J. Infirmary, New Orleans. These conferences will deal with problems related to hospital administration from the standpoint of hospital statistics, personnel, finance and enrollment. The subjects to be discussed have been selected after a recent careful survey of the hospital field.

A hospital information and service bureau will be maintained throughout the Conference to give assistance to any hospital in the selection of its program. A general invitation is extended to hospital trustees, members of the medical and surgical staffs and hospital personnel generally to attend the conference.

#### MEETING MEETING

Attendance at the Philadelphia conference will be limited to a number that can be comfortably accommodated at the clinic, the limit of attendance being based upon the result of a survey of the number of better operating rooms and laboratories in the hospitals and medical schools as to their capacity for accommodation. This plan necessitates registration in advance on the part of all who wish to attend. When the limit of attendance has been reached through advance registration no further application can be accepted.

Attendance at lectures and clinic demonstrations will be controlled by means of special clinic tickets which plan by pre-arranged means in the past for providing the distribution of various surgeons among the several lines and insures against over-crowding in the number of tickets issued for an unlimited limit to the capacity of the room in which that clinic is given.

#### REGISTRATION FEE

A registration fee of \$5.00 is required for each surgeon attending the annual clinic meeting. This fee is for the fund with which to meet the expense of the meeting. Each surgeon registering in advance a small receipt for the registration fee is issued which receipt is to be exchanged for a general admission card upon his registration at the clinic during the meeting. This card which is non-transferable must be presented at the clinic ticket and admission at the evening session.

# CENTRAL SURGERY GYNECOLOGY OBSTETRICS ORTHOPEDICS UROLOGY

## JEFFERSON HOSPITAL

Tuesday

J. TORRANCE RICH—9:30 Othop d  
CHARLES F. VAUGHAN—General surgery  
THOMAS C. STEPHENSON—Orthopedic surgery  
JOHN H. CHAMBERLAIN—General surgery

Wednesday

CHARLES F. JACKSON—Orthopedic surgery for dislocation of femur  
BROCKMAN A. RICHARDSON—General surgery  
W. H. KINNEY—General surgery  
J. H. BLACK—General surgery  
J. CALDWELL & DAVIDSON—General surgery

Thursday

H. R. LOUGH—General surgery  
J. M. FLETCHER—General surgery  
THOMAS A. SHALLOO—General surgery  
ARTHUR DAVIDSON—General surgery  
CHEVALIER JACKSON, CARROLL TUCKER and LEWIS CLARK—General surgery  
General surgery for dislocation of femur

Friday

JOHN J. FLETCHER—General surgery

## EPISCOPAL HOSPITAL

Tuesday

RALPH S. BARNES—General surgery  
LOUIS H. MURPHY—General surgery

Wednesday

ALFRED C. ABBOTT—General surgery  
I. C. ABBOTT—General surgery  
A. BRUCE CULL RUTHERFORD—General surgery  
M. FLETCHER—General surgery

Thursday

I. C. ALEXANDER—General surgery  
H. C. DEWEY—General surgery

Friday

I. T. CROSS—General surgery  
J. H. MURPHY—General surgery  
J. H. BAKER—General surgery

## ORTHOPEDIC HOSPITAL

Tuesday

ALFRED C. ABBOTT—General surgery  
I. C. ABBOTT—General surgery  
I. C. ABBOTT—General surgery

Wednesday

ALFRED C. ABBOTT—General surgery  
I. C. ABBOTT—General surgery  
I. C. ABBOTT—General surgery

Thursday

ALFRED C. ABBOTT—General surgery  
I. C. ABBOTT—General surgery  
I. C. ABBOTT—General surgery

## METHODIST EPISCOPAL HOSPITAL

Tuesday

JAMES H. BALL—General surgery  
B. D. FLETCHER—General surgery  
WILLIAM F. FLETCHER—General surgery  
General surgery for dislocation of femur

Wednesday

WILLIAM M. NICHOLS—General surgery  
General surgery for dislocation of femur  
I. C. ABBOTT—General surgery  
General surgery for dislocation of femur

Thursday

D. M. B. FLETCHER—General surgery  
General surgery for dislocation of femur  
R. H. B. C. NICHOLS—General surgery  
General surgery for dislocation of femur

Friday

J. T. V. MURPHY—General surgery  
General surgery for dislocation of femur  
I. C. ABBOTT—General surgery  
General surgery for dislocation of femur

## ST. MARY'S HOSPITAL

Tuesday

JAMES A. KELLY—General surgery  
WILLIAM F. KELLY—General surgery  
WILLIAM H. KELLY—General surgery  
General surgery for dislocation of femur

Wednesday

WILLIAM A. STEPHENSON—General surgery  
General surgery for dislocation of femur  
A. I. KEEGAN—General surgery  
General surgery for dislocation of femur

Thursday

C. HOWARD MOORE—General surgery  
General surgery for dislocation of femur  
W. T. REES—General surgery  
General surgery for dislocation of femur

Friday

FRED D. HARRIS—General surgery  
WILLIAM M. HARRIS—General surgery  
WILLIAM F. HARRIS and J. STEWART LAWRENCE—General surgery  
General surgery for dislocation of femur  
W. T. REES—General surgery  
General surgery for dislocation of femur

## MEDICO-SURGICAL HOSPITAL

Tuesday

J. B. CARPENTIER—General surgery  
General surgery for dislocation of femur  
W. M. BLOOM—General surgery  
General surgery for dislocation of femur

Wednesday

W. M. BLOOM—General surgery  
General surgery for dislocation of femur  
WILLIAM K. NICHOLS—General surgery  
General surgery for dislocation of femur

Thursday

J. B. CARPENTIER—General surgery  
General surgery for dislocation of femur  
W. M. BLOOM—General surgery  
General surgery for dislocation of femur

## PENNSYLVANIA HOSPITAL

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## POLYCLINIC HOSPITAL

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## ST AGNE HOSPITAL

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## NORTH AVENUE HOSPITAL

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## UNIVERSITY HOSPITAL

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## KENSINGTON HOSPITAL FOR WOMEN

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## PHILADELPHIA GENERAL HOSPITAL

T<sub>1</sub> d

FRANK C. HAMMOND—10 Gynecologic l perat n  
 WILLIAM H. MACKINNEY—2 G to urinary p rat ns

H d d y

ALFRED C. WOOD—9 G r l surgery  
 J. T. RICH—11 O th pedi urgery  
 STAFF—2 Sympos m n Cancer J. B. CAR ETT g eral  
 urgery HE. RV. K. PANCOAST rad l gy C. C.  
 NORRI gynecology J. F. SCHAMBERG le m t l gy  
 ROBERT C. TORREY medical GEORGE M. DO RA CF  
 fac ma ill ry F. O. LEWIS laryng l gy V. W. T.  
 rad m ema at plant d leep th raps labora  
 tones

Th sd v

J. B. CAR ETT J. RALSTY WELLS ROBERT BRADLEY l  
 JAMES P. WEATHERMAN—9 N perati r  
 cl c  
 EDWARD A. SCHULMAN—Cynec l gical perati n

F d a

T. T. THOMAS—9 Ce ralsurg ry  
 C. C. N. RYAN—1 Cynecological l c cane perat  
 EDWARD B. KREMBTAAK d taff f p th logit—4  
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## MISFRICORDIA HOSPITAL

T d v

DAVID BELTRAN and staff—9 C ral rg r  
 JAMES A. KELLY l taff—9 C eral surg ry

H d d

CE ROF I. MILLER and T. W. RYAN—9 C ral  
 rg ry  
 LETER M. KE TING—9 Cl l lem t t  
 J. I. N. JONT—2 Cen ralsurg ry

Th d

B. H. BLIT AN nd t ff—9 C eral rgers  
 JAMES A. KELLY l t ff—9 C eral urg ry

F d

CHARLES P. MILLER nd T. W. RYAN—9 C c l  
 rg ry  
 LETER M. KE TING—9 Cl ncl l m trat n  
 J. I. N. JONT—9 Ge eral rg ry

## NORTHWESTERN CENTRAL HOSPITAL

T d

J. O. AR LD—Obstetr l l I ext m  
 mpo ed tech q

H d d

J. T. SCHELL—9 Gen al rg

Th d

ARTHUR D. KURTZ—3 J Orthoped Jy l c

F d

R. BERT B. AER—Ge to n r l l taff l  
 psoal tect my

## TANKINAW HOSPITAL

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STANLEY I. KILM N—9 D m trati n in ne labora  
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 A. C. MILLER and ROBERT SHOEMAKER—1 Dem n tra  
 ti in roentg n logy  
 I. I. HARTMAN—D mon t ati n off ll up v tem

H d c d a v

STANLEY I. KILM N—9 D m nstrat on i ne l l ra  
 to ry  
 F. L. HARTMAN—Demonstrat n off ll w up v t m  
 A. C. MILLER and ROBERT SHOEMAKER—1 D m tra  
 ti n roe th n l gy  
 J. I. B. DEAVIER—2 G ne l urgery

Th d

F. L. HARTMAN—1 D m t ti off ll w up v t  
 A. C. MILLER and ROBERT SHOEMAKER—1 D m tra  
 ti n roe tgenol gy  
 J. I. B. DEAVIER—Ge ral lery  
 W. I. H. M. KILM N—30 C j t sc p

F d v

ST. LEX P. REINA—9 D m n trat n in ne labora  
 t ry  
 A. C. MILLER and ROBERT SHOEMAKER—1 D m tra  
 ti n r r n l gy  
 I. I. HARTMAN—Dem trati n off ll l v stem

## ST. JOSEPH'S HOSPITAL

T c d a

J. EPH M. PELLIS—9 Dry cl n Operat m cl an  
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 ly  
 J. H. N. JOE—C n r l surgery ppendect my  
 g ll bl l l sc se

H d d

MEL I. M. IR ALI—9 Ge eral surg ry fl nec f  
 l o th tcs pon amput ti ch n n ntubercu  
 lu uppurat n n b e  
 I. HUR T. M. I. RY—Cynec l gy l y terectomy f r  
 my fibrom t pl t c for p ocl t s pen f r  
 r trof

Th d v

J. M. A. K. L—9 Gen rals rg ry fra t r cl n e

F d

CH. I. F. NA SAL—9 Ge e l urg ry l t tal thy  
 ro lect my und l x l nastea a h m q l ty nd r  
 loc l e thes  
 I. BROCKE BLA—1 Cynec l gy p l cat n of rali m  
 f ut n my f t r m m a tr h lorth phy a l per  
 co h phy al l m al hy t rect my

## WOMAN'S COLLEGE HOSPITAL

T d

I. D. S. F. WART COUL—9 I r t l cl n e

H d d

J. S. R. IMA—1 STAFF—9 Ge ral urg ry

Th d y

C. T. W. M. C. R. A. F—2 C neco og

F d v

J. S. K. IMA—1 l t ff—9 Ge rals rg ry



## WOMAN'S HOSPITAL

T e d y

SARAH H. LOCARFY and EMILY WHITTEN ALGER—  
(Gynecology)LIDA STEWART COLL and ELIZABETH HUGHES—  
Obstetrics

JULIA HARDY—Gynecology and ethylen anesthetic

W e d e d y

MIRIAM FORMAN and ALBERTA FELTZ—(Gynecology)

ELLA WILLIAM CRIMM and ALBERTA FELTZ—Obstetrics

JULIA HARTIN—(Gynecology and ethylen anesthetic)

T h r d y

CATHA E. MACFARLANE and FAITH S. LETTERMAN—  
(Gynecology)

MARY LEWIS and DELLA MILBARIAS—Obstetrics

JULIA HARDY—Gynecology and ethylen anesthetic

F r i d y

KATE W. BALDWIN—Gynecology

ELIZABETH T. CLARK—(Gynecology)

ANN TOMLIN, GIBSON and JESSIE W. IRVING—  
Obstetrics

EMILY WHITTEN ALGER—Gynecology

JULIA HARDY—Gynecology and ethylen anesthetic

## STANTON HOSPITAL

T d y

JULIA B. GRAHAM and WILLIAM F. LELAND—  
(Gynecology)

H d d y

S. F. TRACY and ALICE—(Gynecology)

T h r d y

BRUCE M. ANSPACH and ALICE—(Gynecology)

F r i d y

S. F. TRACY and ALICE—(Gynecology)

CARL F. KOENIG—Roentgenology

## CHILDREN'S HOMOGENEOUS HOSPITAL

T d a

H. I. LEPOD—(Gynecology)

H d d

JOHN BROOK—Orthopedic and Medical  
physiotherapy club hospital

T h r d

ALBERTO F. JR.—Obstetrics and Gynecology

## AMERICAN ONCOLOGIC HOSPITAL

T d

W. S. NEVCOMB—(Gynecology and Obstetrics)

SAMUEL McCLARY, JR.—(Gynecology and Obstetrics)

## ST. CHRISTOPHER'S HOSPITAL

T d

I. C. EVANS—(Gynecology and Obstetrics)  
physiotherapy and obstetrics

## HOWARD HOSPITAL

T e d y

A. C. WOOD—General surgery

J. L. ELIASON, DRURY HINTON and V. W. M. WRIGHT—  
10 to 10 General surgery, Industrial surgery, clinic  
Outline of system of records for follow-up, Radiology  
surgery

H d d y

B. C. HIRST—(Gynecology)

T h r d

A. C. WOOD—(General surgery)

J. L. ELIASON, DRURY HINTON and V. W. M. WRIGHT—  
10 to 10 General surgery, Industrial surgery, clinic  
Outline of system of records for follow-up, Radiology  
surgery

J. L. ELIASON—(Gynecology and Obstetrics)

S. W. MOOREHEAD—(Gynecology and Obstetrics)

F r i d y

B. C. HIRST—(Gynecology)

## PRESBYTERIAN HOSPITAL

J. H. J. JOHNS, SPEER, D. B. PFEIFFER, J. S. RICH-  
MAN and HENRY P. BROWN—(Gynecology)JOHN H. CARR, GEORGE M. LAW and PHILIP WILLIAMS—  
(Gynecology)

P. A. THOMAS and T. I. ORR—(Gynecology)

IRVING CRUZER, KNOWLES and HENRY C. ALLEN—  
(Dermatology)J. H. J. JOHNS, SPEER, D. B. PFEIFFER, J. S. RICH-  
MAN and HENRY P. BROWN—(Gynecology)J. H. J. JOHNS, SPEER, D. B. PFEIFFER, J. S. RICH-  
MAN and HENRY P. BROWN—(Gynecology)

WILLIAM S. NEWCOMB—(Gynecology)

Operative clinic daily at 9. Demonstration and  
physiotherapy in new outpatient department

## JEWISH HOSPITAL

T e d y

M. B. RABIN—(Gynecology)

W. H. TFLER—(Gynecology)

H d d y

T. B. BOKA—(Gynecology)

I. RABIN—(Gynecology)

T h r d

M. B. RABIN—(Gynecology)

F. R. BOKA—(Gynecology)

F r i d y

I. B. RABIN—(Gynecology)

W. H. TFLER—(Gynecology)

## WOMAN'S HOMOGENEOUS HOSPITAL

T d a

J. A. BOKA—Orthopedics

H d d y

A. C. HIRST—(Gynecology)

F r i d y

FRANCIS L. HUGHES—(Gynecology)



## COOPER HOSPITAL (Contd.)

T. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Hed. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)  
Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)  
Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Th. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

F. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

## ST. MARK'S HOSPITAL

Tuesday

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)  
Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

H. J. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)  
Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Th. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)  
Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

F. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)  
Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

## SURGERY OF THE EAR, NOSE AND THROAT

## CLINICAL DEMONSTRATION

The following are the results of the clinical demonstration.

T. J. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Hed. J. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Th. J. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

F. J. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

## THE COHEN HOSPITAL

Tuesday

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

H. J. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Th. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

F. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

## HOWARD HOSPITAL

Tuesday

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Th. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

F. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

## ST. MARK'S HOSPITAL

Tuesday

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

Th. J.

Dr. M. H. Lee, Assistant Surgeon and Genl. Surg. (Genl. Surg.)

## WILLS EYE HOSPITAL

T sd y

BURTON CHANCE FRANK C PARKER LEIGH N I A  
PLFMAN and BENJAMIN F BAER JR—2 Ophth lm  
perat s

H d esd y

WILLIAM ZENTMAYER PAUL J PONTIU J MILTON GRI  
COI and THOMAS A O BRIEN— Ophth lm  
perations

Th d

BURTON CHANCE FRANK C PARKER I FIGHTON F AP  
PLEMA and BENJAMIN F BAER JR—2 Ophth l i  
perations

Frid

WILLIAM ZENTMAYER I L L J PONTIU J MILT GRI  
COM a d TI MAS A O BRIEN—2 Ophth lms pe  
tions

## ST JOSEPH'S HOSPITAL

T esd y

GEORGE M MARSHALL— Oul ry gl l y t pl t  
rection f th lbo es rad l m lary n  
perat on

PALL J PONTIUS—2 Ophth lm l y u l t n t l  
gold b l l i serti n d t m y

H d d y

CHARLES J JONES—2 Ophth lm l gy p l m  
inf cto my f cata act simple t ct n

WILLIAM E OLICKSALL—2 Oul lary t ill t m y  
by F tterolf s method submucous csc ti

Th day

THOMAS A O BRIEN— Ophth lmol y mt l  
tr ct n Fil t t ph f gl

ARTHUR WRIGLEY—2 Oul ry gl y pl m t f  
lat rally displ d t p of quad gula t l ge y th  
sub o resect to slectomy l y de p l i

CORNELIUS T MCCRACKEN— Oul ry gl y l l  
m st dectomy thm dectomy

## MEDICO-CHIRURGICAL HOSPITAL

T sd y

GEORGE M COATES—2 Oul y gl l y

ROSS H SAILLERN— Laryng l g

Th d

GEORGE M COATES— Oul ry gl l y

ROSS H SAILLERN—2 Lary gl l y

## WOMAN'S COLLEGE HOSPITAL

T d y

MARY CAREY F BUTLER— Oul ry l y

F sd y

MARY BUTLER—3 Ophthalmol gy

## JEWISH HOSPITAL

W d l

JAN F—3 E l

Th d

S MCC SMITH a I A S K —3 Oul l y l l  
H M C WOOD—4 Nos l th t l

## FRANKFORD HOSPITAL

T d y

FANKFORD—3 T l l m t l l

W J WATSON—9 J T l l

## UNIVERSITY HOSPITAL

T d y

THOMAS B HOLLOWAY— Ophth lm l y  
C FETTEROLF J A BABBITT D HUSIK n l l e a s  
F l H L R—3 Oul lary n l y

W d sd

C L TTERO J A BABBITT D HUSIK n l l l l H L R—  
3 Oul lary n l y

Th d

THOMAS B HOLLOWAY—2 Ophth lm l y

F da

THOMAS B HOLLOWAY— Ophthalmol gy  
C RCF LITTLEOLF J A BABBITT D HUSIK and  
LE IS F l H L R—3 Oul l y l y

## MISERICORDIA HOSPITAL

T d

JAN L L L L— Oul lary n l y

H d d y

C L M C RETHY—2 Oul lary n l y

HAROLD COLDBRIDGE—3 Ophth lm l y

Th sd

JAN L LOFTLY— Oul lary n l y

JAN L L L L—3 Ophth lm l y

F t

C L M C RETHY— Oul l y l y

## IOUAIICIN HOSPITAL

T d y

I B H L L L L— Ophth lm l y

B d d

W L T R R BIRTS—2 Oul l y gl l y

I B L L L L—3 Oul l y gl l y

I C PETER—3 Ophthalm l y

T l sd y

C L B WOOD—3 Laryng l y

I B L L L L—3 Laryng l y

## HABERMAN HOSPITAL

T sd y

C J PATER— Re um e of m st d pe t m l y t l l  
l l p a t m t

T l sd y

H S WEAVER d C B HOLLI—2 N and thro t  
l n e

I d y

I O N A L F— Gynecinc P th l gy f th y e

## ST ANNE'S HOSPITAL

T d y

B E J I D I A —2 Oul lary n l y

H d d y

W R I B DAVIS—2 Oul lary n l y

C F O R C I J KELLA—2 Ophth lm l y

## METHODIST EPISCOPAL HOSPITAL

T sd

W L T R R BIRTS— D t t l m t n l l m  
n l l l e c t m e s m t l d e c l m l g n a t  
l s e f th lary n bronch s c l y

W L L L H L L L L—4 Fnu l e t n f gn body the  
y t r a t m g l a c m y







Surgical Association in 1924 and for twenty five years from 1900 professor of clinical surgery in the University of Illinois Medical Department

But why recapitulate these scientific activities which are so well known to all? As my lifelong friend my companion in traveling both at home and abroad it is Ochsner the man of whom I wish to speak. Honest sincere kindly I never knew him to say a word or do an act that little children might not have heard or seen. An instinctive courtesy and consideration for others and charity under all circumstances were his most conspicuous traits. A man of strong convictions and independent thought he always conceded the same rights to others. He was interested in young men in medicine and supported and helped to educate a group of grateful students.

In the death of Ochsner I feel a great personal loss which words fail me to express. Spiritually morally and professionally I profited greatly from my association with him. Tribute had been paid Dr. Ochsner in universal expressions of regret and in expressions of sympathy to his family especially to his wife who labored faithfully by his side for more than thirty years.

A gallant soul has passed from us. His memory will be a sacred heritage to those who had the privilege of knowing him.

WILLIAM J MAYO

## AN APPRECIATION

IN the death of Albert J. Ochsner the American College of Surgeons shares with the whole medical world an irreparable loss. He was the first president of the Clinical Congress, one of the Founders and a past president of the College, its treasurer and constant supporter and counsellor from its inception and one of the Editorial Staff of this its official Journal.

Ochsner typified strength in every phase of his intellectual and physical being. One must have known him and have appreciated his character to understand how a man who so consistently shunned the spectacular and who possessed his inherent modesty could attain his eminence and wield his influence in the medical profession and in civic society. The great balance of this man of gigantic accomplishments was his force of character supported by a strong physique and a keen intellect which never were impaired or confused by disipation. His heritage afforded an adequate background which was refined by educational advantages and at the very outset he proved himself a man of vision and of scientific force as evidenced by his thesis on microscopical investigations in embryology based on work which he had done while an undergraduate student which won for him a Fellowship in the Royal Microscopical Society. To his natural advantages he added untiring industry, unyielding perseverance, unerring judgment.

and unimpeachable honesty he was devoted to his profession had a personal interest in his associates and patients lent his enthusiastic support to professional and lay societies and was a lover of Art—pictures sculpture and music

Ochsner with his pleasing personality and his love of peace was an uncompromising foe of all kinds of hypocrisy in living and unethical shifting in the profession With his scientific mind tuned to accuracy he was utterly unappreciative of the subtlety of creeds yet all of his life he worked harmoniously and sympathetically in hospitals controlled by people of the strongest beliefs and in his personal contact with peoples of all creeds especially the poor and the helpless his attitude was that of the Master Himself The Golden Rule was his guiding principle

The epoch making anti fee splitting pledge of the American College of Surgeons was written by Doctor Ochsner and he defended it with strong arguments and was in the forefront in the uncompromising enforcement of it It is the Sermon on the Mount in medicine of the present and for the future its meaning is unmistakable and its language is not obscured by ornamentation

The presidential gown of the American College of Surgeons in which Doctor Ochsner was laid to rest was placed upon him by Mrs Ochsner who said it was her feeling that this was a fitting tribute to the College in view of Doctor Ochsner's love for and pride in the organization

FRANKLIN H MARTIN

Doctor Ochsner was born at Baraboo Wisconsin on April 3 1858 son of Henry and Judith (Hottinger) Ochsner B Sc University of Wisconsin 1884 LL D 1909 M D Tufts Medical College 1886 interne Presbyterian Hospital 1886-1887 Post Graduate courses Universities of Vienna and Berlin 1887-1888 Married Marion H Mitchell of Chicago April 3 1888 Children Albert Henry and Bertha Practiced in Chicago 1889-1925 instructor in surgery Rush Medical College 1889 1895 professor of clinical surgery University of Illinois College of Medicine 1900-1925 chief surgeon Augustana Hospital 1891-1925 and St Mary's Hospital 1896-1925 Spent two weeks of every three months at various surgical clinics in the United States 1895-1907 First Lieutenant U S Medical Reserve Corps 1908-1916 Major U S Medical Reserve Corp 1916 on active duty during late war President Clinical Congress of Surgeons of North America 1910 1912 Founder of American College of Surgeons Legend and Treasurer 1913-1925 President 1923-1924 Fellow American Surgical Association (President 1924) member Southern Surgical and Gynecological Society American Medical Association (Chairman Surgical Section 1901) Illinois State Medical Society Chicago Medical Society Chicago Pathological Society Chicago Surgical Society International Society of Surgeons Fellow Royal Microscopical Society of England Honorary Fellow Royal College of Surgeons in Ireland Honorary Member National Academy of Medicine of Mexico National Surgical Society of the Republic of Switzerland and Medical Society of Stockholm Member of Editorial Staff SURGERY GYNECOLOGY AND OBSTETRICS Author Handbook on Appendicitis (1st edition 1902 2d edition 1906) Clinical Surgery for the Instruction of Practitioners and Students (1st edition 1902 2d edition 1905 3d edition 1912) Thyroid and Parathyroid Gland 1910 Yearbook on Surgery 1917-1925 Surgery of the Thyroid Gland Treatise on Surgical Diagnosis and Treatment 1918 Organization Management and Construction of Hospital (1st edition 1907 2d edition 1913) and many monographs on surgical subjects





## NOMENCLATURE

It is not the writers intention or hope to determine which of the several names that have been given to the methods of illumination and inspection of the abdominal cavity shall have precedence and should be adopted. In general such attempts prove futile. More or less chance establishes tradition here the usage of a name. That an accepted term may not always be explicit or may become narrowed in its meaning is well illustrated by the general term endoscopy which today is commonly employed to designate the endoscopic examination of cavities in connection with the throat. None the less the writers wish to express their preference in the choice of a term. The following names may be considered

- 1 Cœlioscöpy (Kelling 1901)
- 2 Ventroscöpy (von Ott 1901)
- 3 Laparoscöpy (Jacobæus 1911)
- 4 Organoscöpy (Bernheim 1911)
- 5 Peritoneoscöpy (Orndoff 1920)
- 6 Abdominoscopy (medical dictionaries later Steiner 1924)
- 7 Celoscöpy (medical dictionaries)
- 8 Splanchno copy (medical dictionaries)

Since Kelling first used the term *cœlioscöpy* specifically for the method of endoscopy of the abdomen it would seem fitting to favor it among the terms proposed. However the prefix *cælio* from the Greek *kœlia* the belly is not as familiar to the medical man as is *lapara* (flanks or loins) or the Latin derived *abdomen*. The same objection holds for *entroscöpy* and for *celoscöpy*. The term *organoscöpy* is not definite enough whereas that of *peritoneoscöpy* we consider too restricted for not only does the endoscope reveal the appearance of the peritoneum but to a considerable degree also the organs covered by it. The word *splanchnoscöpy* given many years ago to a method of transillumination of the walls of the body organ cavities and cysts is now reserved to denote the examination of the viscera with roentgen rays. The term *laparoscöpy* is apparently destined to become the accepted standard appellation of endoscopy of the abdomen in Europe where Jacobæus and his followers have written extensively under that title. Even so the writer prefers the term *abdominoscopy*.

TECHNIQUE OF ABDOMINOSCOPY  
AS PRACTICED BY THE WRITERS

As has been shown in the above review the method of abdominal endoscopy developed by such authors as Jacobæus Nordentoft Orndoff Korbisch Stone et al in the main agree with that first devised by Kelling. Respecting certain details of procedure different suggestions were advanced. It is also apparent that some technical difficulties hindered the widespread adoption of abdominoscopy and were the chief cause of its abandonment by some men who had tried it. Hoping that we might contribute something toward overcoming those obstacles experiments were carried on with several types of apparatus. The aim was to obtain a method which in the first place was effective in the second easy of application and in the third made it possible to employ any endoscope with which the observer is familiar.

Like Kelling the writers soon found it to be advantageous to use an endoscope which is bent at its distal end (Fig 1 D). Thereby it can function also as a retractor pushing aside organs or parts of organs and bring in into view structures to their side or beneath them. This aid proved especially useful in the region of the liver bile ducts and stomach (Fig 1 G).

**Cannula and trocar.** In making an endoscope of the angled type just indicated the problem arose of contriving a cannula which would allow the endoscope to pass through it. This was accomplished by constructing a flexible cannula made of a thin spiral steel spring which was covered with a fine sheath of rubber (Fig 1 C). The bore of the cannula is such that the tube of a cystoscope of No 26 F dimensions just slips through it. The outside diameter of the cannula is approximately 1 centimeter and its length 10 centimeters. One of greater length say 12 centimeters should be used in cases in which the abdominal wall is obese.

A circular screw cap adapted to a perforated rubber diaphragm (Fig 1 C1) fits on the upper or proximal end of the cannula and prevents the escape of air from the body cavity after the introduction of the endoscope.

A trocar stylet having a sharp bevelled point with three facets (Fig 1 B) is used to

place the cannula in the abdominal wall. It is of such form and size that it will easily pierce the different tissue layers and yet if carefully manipulated not injure the intestines of the inflated abdomen.<sup>1</sup>

**Endoscope.** In trying out several kinds of endoscopes the writers found that an ordinary No. 26 direct vision cystoscope such as the Braasch (Fig. 1 D) served them the best. Orientation within the body cavity was easiest with it because there are no lenses or prisms to magnify or reflect the image. True a direct cystoscope has a fault in that the field of vision at any one time is small, being only about 3 centimeters in diameter. But in actual practice one soon learns to carry the impressions in the mind as the instrument is moved about. Observers who are more at home with the indirect type of cystoscope, the Brown Buerger (Fig. 1 E) for example, naturally will obtain the best results with such an instrument.

**Apparatus needed.** The appliances necessary for the performance of abdominoscopy are relatively few in number and consist of the following: A trocar and cannula as described, a cystoscope direct or indirect, a No. 18 spinal puncture needle (Fig. 1 F), a hypodermic syringe and needle, a small scalpel and a small foot pump, rubber tubing and connections for inflating the abdomen.

**Sterilization of instruments.** The rubber tubing and all instruments except the cystoscopes may be sterilized in the usual manner by boiling. The latter are made aseptic by keeping them for 20 minutes in a mercuric cyanide solution having a strength of 1 to 1000. Obviously it is not necessary to sterilize the air pump.

**Position of patient.** The table used during the examination should be of such construction and the patient so fastened to it that any region of the body, especially the upper and lower ends, may be safely and easily raised or lowered (Fig. 3). In this way the position of the viscera may be altered and the viewing of particular structures with the endoscope facilitated.

**Site of entry.** The writers generally selected a point in the vicinity of the umbilicus.

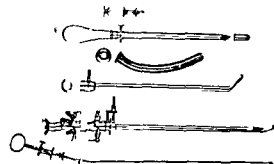


Fig. 1. Instruments used in blind endoscopy. 1. Spinal puncture needle. 2. Trocar and cannula. 3. Trocar stylet. 4. Flexible trocar. 5. Cannula with screw cap. 6. Containing gas for inflating the abdomen. 7. Braasch cystoscope (direct vision). 8. No. 18 spinal needle. 9. Brown Buerger cystoscope (indirect vision). 10. Foot pump. 11. Rubber tubing. 12. Connections for inflating the abdomen.

centimeters to the right for the passage of the trocar through the abdominal wall (Fig. 4 B). This is a favorable locality, not only because the viscera in the upper and the lower abdomen may be easily observed, but also because the opening into the belly is through the rectus muscle, the fibers of which contract around the cannula, preventing the leakage of air from within and assist the closure of the wound after its withdrawal. It is hardly necessary to remark that the trocar in certain other cases may be introduced with equal advantage at other points of the ventral abdominal wall, provided the caution is heeded of avoiding the course of the deep epigastric artery and the linea alba.

At the chosen point of entry, a small bleb about 2 centimeters across is made under the skin with a 1 per cent novocain solution. The hypodermic needle is then carried by stages deeper to anesthetize the subcutaneous tissue and the rectus fascia, and finally is brought down to the peritoneum (Fig. 4 A) where the subperitoneal tissue is infiltrated with approximately 3 cubic centimeters of the solution. The peritoneum being very sensitive its thorough infiltration is required.

**Pneumoperitoneum.** An incision 1 centimeter long is made in the anesthetized skin (Fig. 4 B). Here the spinal needle, the point of which is not too sharp, together with its obturator is pushed through the several layers



Fig. 1. Inlet tube, foot pump, and the abdominal wall. The foot pump is connected to the inlet tube, which is inserted into the abdominal wall. The foot pump is used to inflate the abdominal cavity.

of the abdominal wall (Fig. 4 C) until the peritoneum is pierced. This is felt as a sudden release in the pressure applied. We have never found the needle to injure the bowel or the omentum. The obturator is removed from the lumen of the needle and the sterile tube connections are joined, one end to the needle and the other to the air pump (Fig. 2). Interposed in the rubber hose is a short glass tube of

somewhat larger caliber (Fig. 2) which is filled with dry sterile cotton for filtering the air.

The next step is to pump air into the peritoneal cavity (Fig. 4 D) by means of the bellows, the Buffalo dental foot pump (Fig. 2) functioning in this capacity. Air was used in preference to oxygen, carbon dioxide, nitrogen or other gases as a medium of inflation because it is always available. Any slight amount which might remain within the abdominal cavity after the examination is absorbed in time.

In the production of pneumoperitoneum brief reference may be made to our experiments with dogs. We wished to determine the absorbing power of the peritoneum for air and also what changes if any occurred in the composition of the air left within its cavity. Accordingly we inflated the abdomen of 5 medium sized dogs with filtered air to the volume of 1,500 to 1,700 cubic centimeters. At intervals of several days different dogs were deflated and the air recovered was measured and analyzed. These experiments and the results obtained are expressed in tabular form as follows.

The table shows that the absorption of air from the peritoneal cavity proceeds relatively slowly but at a definite rate. At the end of 5 days approximately 35 per cent of the amount introduced had been absorbed. At the end of 7 days 45 per cent and at the end of 12 days 65 per cent.

Regarding the composition of the air within the abdominal cavity it will be observed from the above table that the gases nitrogen, oxygen and carbon dioxide tend to establish soon equilibrium in their ratio to one another. The analysis of the room atmosphere used for inflation had the following composition: 79.1 per cent of nitrogen and 20.88 per cent of oxygen with a trace of carbon dioxide amount

TABLE I.—ABSORPTION OF AIR IN PNEUMOPERITONEUM

Dog	Weight kg.	Dose ml.	Volume C. b.	Time days	Volume C. b.	Percentage absorbed	Volume C. b.	Percentage absorbed	Analysis of gas		
									N <sub>2</sub>	O <sub>2</sub>	CO <sub>2</sub>
1	10	8	68	5	6	8.8	62	89	6	6	6
2	8	8	58	5	6	10.3	52	84	6	6	6
3	8	8	58	7	6	10.3	52	86	6	6	6
4	8	8	60	7	6	10.3	52	86	6	6	6
5	8	8	60	7	6	10.3	52	86	6	6	6

ing to less than  $\frac{1}{20}$  of 1 per cent. On the other hand the average percentages of these gases in the air from the peritoneal cavity of the 5 dogs were 87.2 (nitrogen), 6.2 (oxygen) and 6.6 (carbon dioxide) respectively.

Before the experiments in inflation were undertaken the writers assumed that a considerable volume of air pumped into the abdominal cavity would result in a marked increase of the intra-abdominal pressure. To their surprise however this did not exceed 3 to 8 millimeters of mercury even after a liter and a half of air had been forced into the abdomen of a medium sized dog and it appeared very much distended. Unquestionably as soon as the maximum expansion of the abdomen has been attained continued inflation would soon register a high pressure. Not to give the animal undue pain inflation was stopped before this point was reached. In the human it is not necessary to carry inflation even proportionately to the degree we produced in dogs. A moderate unmeasured quantity of air within the abdominal cavity is entirely sufficient to perform endoscopy successfully.

*Passage of the trocar and the cannula.* After enough air has been introduced into the peritoneal cavity to raise its walls some distance from the underlying bowel (Fig. 4 D) the spinal needle is withdrawn and the trocar along with its flexible cannula is placed in the small skin incision and pushed gently through the belly wall (Fig. 4 E). Needless to say it is essential while doing this to have complete control of the strength and pressure applied. In cases in which peritoneal adhesions are suspected it is wise to execute this action in front of the fluoroscopic screen. The stylet is removed, the metal cap with rubber diaphragm (Fig. 1 C1) screwed on the cannula and the endoscope passed through the latter (Fig. 4 F). Since most of the air escapes from the body cavity at the withdrawal of the trocar stylet it is necessary to reinflate it through the endoscope. Then as soon as the proper electrical connections are made with the lamp of the instrument the examination can proceed (Fig. 3).

*Endoscopic exploration.* On looking through the endoscope when it is in the perpendicular



Fig. 3. The distended abdomen of a patient has been passed into the abdomen through the trocar and cannula. The patient is tilted at an angle of 20 to 30 degrees. The light connection is visible.

position one immediately sees the yellow omentum and its red blood vessels. By moving the instrument about that is changing its direction or angle with the body surface and pushing it further in or out much of the abdominal viscera is made visible by steps. On account of the difficulties of orientation it is important that the observer especially the beginner conduct his inspection in a systematic manner in other words proceed from structure to structure in regional order. When viewing the upper abdomen it is well to elevate the head of the patient to 20 or 30 degrees. This causes the coils of the intestine to fall away from the liver and diaphragm and hence exposes greater areas of these organs. The gall bladder is easily identified by its



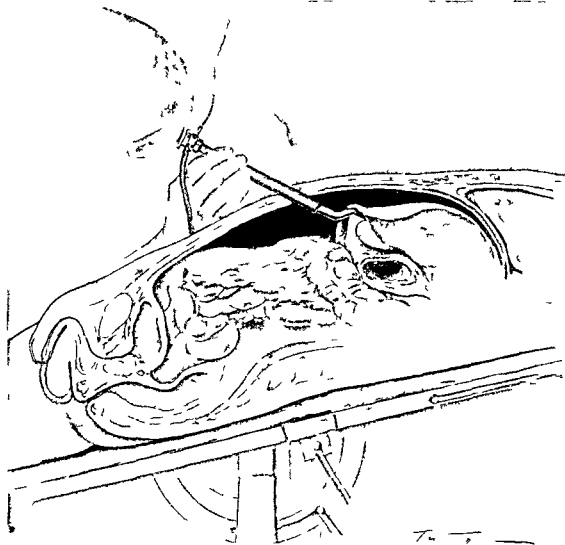


FIG. 5. Abdominotomy.

human where the omentum is thick as compared with the thin veil like one of the dog.

The adhesion just mentioned was the only one that had developed after the use of the method. As the autopsies showed the puncture wounds had healed so perfectly that it was sometimes difficult to find the scar on the peritoneal surface. At most the margins of the scars were lightly puckered.

Repeated abdominoscopic exploration on the same dog failed to produce peritonitis or any accumulation of peritoneal fluid. Nor at

any time was it found that the trocar and the endoscope had damaged the viscera.

Abdominotomy was done on 3 patients. True, this does not represent an extensive clinical experience but the results obtained surpassed the expectations of the writers and confirmed the statement made by previous investigators regarding its value in diagnosis. This function of the method and the indications and contra indications to it are illustrated in the following reports of the cases examined.



hooking the endoscope under the cystic duct it was stretched to bring into view the common duct and the junction of the hepatic with it. Just to the left of the common duct near its middle another metastasis was seen.

The omentum was pushed aside to uncover the small intestines. Here in the mesentery of the jejunum were numerous metastatic nodules for the most part smaller than those described above. It was interesting too to see the white lacteals which were prominent in the mesentery for the patient had eaten not long before the examination.

Throughout the endoscopic observation the patient manifested much interest in the remarks made by us so that we were compelled to express our findings surreptitiously. He evinced neither pain nor discomfort except once when the air pressure within the abdomen became too high and he complained of shortness of breath and substernal distress. Immediate relief was given by allowing some of the air to escape.

It is quite obvious that in this case the endoscope demonstrated the utter hopelessness of an operation for the removal of the tumor.

**CASE 3.** An Italian laborer 52 years of age entered Augustana Hospital on February 17, 1925. His chief complaint was a pain in the epigastrium and beneath the sternum. He stated that recently he had lost rapidly in weight, this having dropped from 135 to approximately 100 pounds. He was well until 4 months ago when he felt a sharp cutting pain lasting but a few moments in the upper abdomen and a little to the left of the midline. This pain recurred two or three times every day and apparently stood in no relation to the intake of food. He has gradually grown very weak. During the 4 months he has been sweating profusely, but he denies having a chronic cough. He stopped working 2 months ago and has been in bed for 2 months. His appetite has disappeared when he did take food he had the feeling that it became lodged behind the sternum. The pains arose more frequently and might appear at any time of the day or night. Constipation began with the onset of the first symptoms, he often went several days without a bowel movement. The stools were light yellow.

Regarding his past history he stated that he had had malaria as a child in Italy. He is married and his wife is living but they have had no children. No family history of tuberculosis or of carcinoma could be elicited.

Physical examination revealed a man with a facial expression of pain, a body much emaciated and a skin dusky, sallow and apparently icteric. He had carious teeth and a foul breath. The chest was narrow and it was sunken at the sternum. There was a slightly impaired percussion note over the entire chest and an increased fremitus excepting over the left lower lobe of the lung where it was diminished.

Few râles were scattered over both lungs posteriorly. The abdomen was flat and the muscles were moderately tense. On palpation the patient complained of marked tenderness over the epigastrium especially toward the left.

The examination of the blood showed 3,600,000 red cells, a hemoglobin of 62 per cent and 6,500 white cells. Lymphocytes constituted 45, neutrophils 48 and eosinophiles 6 per cent of the total number of leucocytes. The urine proved negative except that it was highly concentrated. A specimen of sputum was sent to the laboratory.

In front of the roentgen screen the barium meal was seen entering the cardia without obstruction. But the pylorus seemed narrowed and no barium passed through it during the first 20 minutes. There was retention over 6 hours. On the greater curvature near the pylorus a filling defect was detected which persisted during fluoroscopy and appeared on the photographic film.

On the basis of the above signs the clinical diagnosis of carcinoma of the stomach and pyloric obstruction was made besides that of a possible pulmonary tuberculosis.

On February 26 abdominocopy was performed to determine the operability of the gastric tumor. The omentum the first structure seen was thin but unusually red in color. The blood vessels over the coils of small intestine too were injected. We gained the general impression of the existence of a moderate inflammatory reaction throughout the abdominal cavity. Upon minute inspection numerous small white masses averaging 1 millimeter or less in diameter and each surrounded by a narrow zone of dull red color were found scattered over the peritoneum. In the upper abdomen especially over the liver and diaphragm conglomerate masses of the same lesions occurred. Between the loops of the small intestines stretched many veil-like adhesions (Fig. 6). A small quantity of slightly cloudy fluid collected in both flanks after retraction of the intestines.

The wall of the stomach which according to the roentgen picture possibly contained a tumor mass near the pyloric region were found by palpation with the endoscope to be soft. No evidence of such a lesion was observed. Whether or not the dorsal surface differed we are unable to say because that side is not accessible to the endoscope. The gall bladder was not distended and was emptied by pressure of the instrument upon it. Active peristalsis was visible in both the stomach and jejunum.

The abdominoscopic findings led to the diagnosis of a milary tuberculous peritonitis. Several hours later the laboratory report informed us of the presence of many tubercle bacilli in the sputum. Accordingly we were justified in making the final diagnosis of a general milary tuberculosis.

The case just considered illustrates strikingly the efficacy of the abdominoscopic method for here the clinical diagnosis of car-



cinoma of the stomach was made on good grounds we believe and yet failed of substantiation because of entirely different evidence revealed by the endoscope.

In conclusion a statement is warranted respecting the future of abdominoscopy and the circumstances that will probably govern its course. Obviously the primary difficulties of the method lie in the orientation with the endoscope in the circumscribed field which it makes visible at any one time and in the interpretation of the things seen. To meet the objections which have been brought against the method it is necessary to emphasize that if it is to produce results the observer must have the following qualifications: practical familiarity with cystoscopic examination, an accurate knowledge of the topography of the abdominal viscera and the training to recognize the distinctions of gross and surface appearances of pathological lesions of the organs. Hence it is evident that abdominoscopy will not be successful in the hands of every practitioner but must be reserved for the specialist such as the cystoscopist and the diagnostician.

In spite of the limitations pointed out we cannot agree with Jacobaeus when he says:

Abdominoscopy does not have the practical possibilities that thoracoscopy has. On the contrary we are convinced it will outstrip thoracoscopy in the extent of its application and in its development. As a diagnostic method it has already proved its worth many times. From a perusal of the literature we know that the reported cases of abdominoscopy on humans number at least 60. But not only in diagnosis is in treatment as well will this method achieve favor just as the cystoscope, the bronchoscope and the thoracoscope have extended their domain of action to include operative procedure. The separation of certain types of peritoneal adhesions, the internal application of drugs or the execution of other therapeutic measures with the guidance of the endoscope represent the direction which the further clinical development of the method probably will take.

Aide from its clinical importance the method of abdominoscopy will in the future be utilized more widely we believe as a

technical aid in certain kinds of animal experimentation. Such physiological problems as peristalsis, peritoneal absorption, the flow of chyle, sympathetic nerve reactions, the cyclic changes of the ovary, et cetera are revealed to the eye under more normal conditions and those not yet solved will perhaps be brought nearer solution. Moreover in experimental surgical work within the body cavities of animals the endoscope in many cases will permit the investigator to trace step by step the postoperative changes in the lesions which he has set without finding it necessary to resort to a more extensive second laparotomy. Not to mention a postmortem examination. Finally in the course of abdominoscopic inspection of human patients for diagnostic purposes some physiological observations can now and then be made incidentally which may prove of great practical value. We have in mind particularly the aid which the fully awake patient can give in the study of visceral pain and sensations, their localization or reference and the sympathetic reflexes and reactions when exactly known localities of the different viscera are touched or stimulated in diverse ways.

At the close of this paper we wish to present a list of the names of the persons who have contributed to the work in this field.

#### SUMMARY

1. Abdominoscopy represents the endoscopic method of examining the abdominal cavity, a method which is not utilized as much as it deserves.

2. Such endoscopy if carefully executed is a relatively simple and safe procedure.

3. Originally devised and applied by Kelling some 25 years ago the method in its technical details has been but slightly modified by subsequent work. At least 25 investigators or observers have published work concerning it.

4. The technique as described consists in producing a preliminary pneumoperitoneum passing a trocar through the locally anesthetized abdominal wall and on its withdrawal leaving in place a flexible and airtight sheath. This cannula then permits the introduction of any type of cystoscope preferred by the ob-

server—an instrument either straight or curved and adapted for either direct or in direct vision.

5 With the cystoscope an excellent view may be obtained of the interior of the abdomen particularly in the region of the stomach liver and bile tracts and in the pelvic region.

6 The kinds of operative or therapeutic measures performed with the guidance of the cystoscope in the urinary bladder may also be carried out in the abdomen.

7 In some cases peritoneal adhesions form the chief drawback to the employment of abdominaloscopy.

8 The diagnostician using the method must be familiar with cystoscopy and with the normal and pathological topography of the abdomen.

9 The writers convinced of the great practical possibilities inherent in this method recommend its wider use in clinical as well as in experimental work.

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DIABETES IN SURGICAL PATIENTS WITH ESPECIAL REFERENCE TO INSULIN<sup>1</sup>

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**T**HE diabetic patient with surgical complications requires more medical attention than does the patient without such complications. Diets are revised more frequently not only with regard to composition but also with respect to physical state and digestibility. This is especially true during the days immediately following an operation or when vomiting, hiccough or fever occur. The dose of insulin has to be changed more often because of rapid development of hyperglycemia and acidosis or inability to consume a prescribed diet on account of anorexia, nausea or vomiting. Again after operation digitalis is more frequently required to support the circulation so that the urine output does not decrease sufficiently to interfere with the elimination of acetone bodies or urea. Finally the administration of fluids by vein hypodermatically or by rectum must be resorted to more often than in uncomplicated diabetes.

Not many years ago operations on diabetic patients were approached with considerable anxiety. Relatively short surgical procedures were often followed by rapid production of ketone bodies resulting in coma and death. At present with insulin and medical supervision the operative risk in diabetic patients does not appear to be greater than in the non-diabetic. Thus in a recent article Allen states that thorough dietary preparation is advisable when possible and makes operation on diabetic patients practically as safe as on the non-diabetic. America has reversed the old European rule that surgery on patients with diabetes should be avoided as far as possible. Wilder and Adams (9) state that the operation mortality in diabetes at the Mayo Clinic had been about 7 per cent but that during the past 2 years 327 operations were performed on 251 diabetic patients with only 1.2 per cent of deaths. The authors believe that the reduction in mortality is due

to the assistance of the internist who has become a part of the surgical team. Obviously their clinical material differs somewhat from that encountered in the emergency wards of metropolitan hospitals. Foster (5) reports a death rate of 12 per cent at the New York Hospital during the first year following the introduction of insulin as compared with a 40 per cent mortality for the decade preceding.

Even light absorption from infected tissue may have a marked adverse effect on the utilization of glucose by the diabetic organism. The exact explanation for this phenomenon is still outstanding. Whether an influence is exercised on the cells of the Langerhans islands resulting in a decreased production of insulin whether the mechanism of insulin action is interfered with or whether the mobilization of glycogen is accelerated has not been definitely established. Insulin may often be omitted when absorption from an infected area has subsided. Rabinowitch (7) found that in gangrene or infection there was a delay or absence of the rapid fall in blood sugar which usually follows the injection of insulin in uncomplicated diabetic patients.

With regard to energy requirements it may be said that patients who are to remain in the hospital for a short time or who are overweight receive 1500 to 2000 calories otherwise 2000 to 3000 may be required.

The dose and frequency of insulin administration varies with the diet, degree of acidosis and hyperglycemia. The time of insulin administration has usually been one half hour before meals the larger doses being given before breakfast and supper.

Instances of apparent psychical or emotional glycosuria are observed after severe injuries. The exact mechanism of this transient glycosuria which may occur in an otherwise normal person is not clear. The following cases are illustrative.

J C 34 years of age history number 58320 suffered an automobile accident resulting in fractures of the radius and scapula and skin injuries. He excreted considerable sugar on the day of admission only a trace the next day and none on the third day. No blood estimation was made. No anæsthetic was administered. There was no previous history of diabetes.

S B 6 years of age history number 56848 was thrown by a truck. On admission April 21 1923 he appeared to be in shock somewhat dyspnoic and cyanosed. He had a greenstick fracture of the left clavicle a lacerated wound of the left arm and rupture of the right lung with pneumothorax. The urine on April 22 contained considerable sugar on the second day it contained less sugar but considerable acetone and diacetic acid on the third day it was sugar free. Patient gave normal reaction to a glucose tolerance test on May 1923. No anæsthetic was used.

S P 29 years of age history number 57503 sustained a fracture of the ilium and rupture of the acromioclavicular ligament as a result of a motor cycle accident. The urine on admission contained considerable sugar. The next day the urine was sugar free and the blood sugar 0.13 per cent. On the third day after admission the blood sugar was 0.10 per cent. No anæsthetic was used.

H C 12 years of age history number 59284 was admitted on February 25 1924 for rupture of the liver and hæmorrhage into the peritoneal cavity following a coasting accident. Laparotomy was done under ethylene anæsthesia on February 26. She excreted sugar for 4 days after the accident. The blood sugar on February 26 was 0.10 per cent.

The above data are not sufficient to permit a definite conclusion regarding the mechanism of the glycosuria. The patients were too sick for extensive studies of the blood. The 24 hour specimens of urine could not be obtained.

Lactating women who are compelled to stop nursing on account of a surgical emergency may excrete urine which reduces alkaline copper solution. This is obviously due to lactose which is reabsorbed into the blood from the overdistended mammary gland and excreted in the urine. There is apparently no ferment in the blood or tissues which can hydrolyze this sugar into its components glucose and galactose. This disaccharide may be differentiated from glucose as it is not fermented by ordinary yeast and forms mucic acid when oxidized with nitric acid.

Regarding the incidence of diabetes before during or after pancreatitis it is noteworthy that of 48 verified cases at the Presbyterian Hospital diabetes occurred in only 3.

Ether anæsthesia is apt to be followed by vomiting it lowers the bicarbonate content of the blood and raises the sugar in normal individuals and should therefore be used as sparingly as possible in diabetes. Local anæsthesia with novocain is preferable if it enables the surgeon to carry out the operation satisfactorily without inflicting too much pain. One is astonished at the amount of manipulation that can be done without distress to the patient. When more relaxation is required nitrous oxide is preferable to ether because it has less effect on blood sugar and bicarbonate and is less apt to produce vomiting. The recently proposed ethylene seems to have little effect on blood sugar and alkali in non diabetic individuals. The effect is more pronounced in diabetic subjects.

Table I records the effect of various anæsthetics on the blood sugar and bicarbonate of non-diabetic patients. The action of ethylene on the blood of diabetics is based on studies of 3 patients a totally inadequate number but the figures are at least suggestive.

In abdominal operations ether may be necessary to procure relaxation but it should be used as sparingly as possible.

#### THE SURGICAL COMPLICATIONS OF DIABETES

The surgical complications of diabetes may be divided into two main groups those more or less characteristic of the disease (that is carbuncle and gangrene) and those which are purely accidental. For practical purposes the latter may be subdivided into conditions that require immediate operation and those for which operation may be deferred.

*Carbuncle (cellulitis and abscess)* Between January 1918 and July 1924 a period of 6½ years 39 diabetic patients were operated on for the infections mentioned. Of these 13 had true carbuncle. Ten of the 13 deaths which occurred in this group were due to bacteræmia and of these 4 followed carbuncle. Hæmolytic staphylococcus aureus was found in the blood of 9 patients and the non hæmolytic staphylococcus albus in one.

Diabetic patients appear to be more susceptible to pyogenic infections and their

TABLE I—A FRAGLE CHANGE IN BLOOD SUGAR AND BICARBONATE FOLLOWING NITROUS OXIDE AND ETHER NITROUS OXIDE ALONE AND ETHYLENE

Author	No. of Patients	Increase in blood sugar per cent	Decrease in bicarbonate per cent	Notes
Paterson and Aschner (5)	65	46		Nitrous oxide and ether
Fry and Aschner (5)	65	64.5		Nitrous oxide and ether
Paterson and Brenner (4)		76		Nitrous oxide and ether
Morris (5)			8.8	Nitrous oxide and ether
Caldwell and Cleveland ( )	4		6	Nitrous oxide and ether
Caldwell and Cleveland ( )			5	Nitrous oxide
Paterson and Aschner (5)	5	5		Nitrous oxide
Lim	7	8		Ethylene
Dumas	5	75	4	Ethylene in diabetes

tissues seem to be less resistant to the spread of infection once it is established. Extensive infection and suppuration may be uncomplicated by corresponding local or general signs or symptoms. Carbuncles may become dangerous on account of accompanying acidosis or because of spread of infection to adjacent tissues or to the blood stream. In mild diabetic patients bacteremia may occur without hyperglycemia or acidosis. It is usually a fatal complication which is accompanied by multiple abscesses some of which are characteristically located in the lungs. It remains to be seen whether the chemotherapeutic measures recently advocated will sterilize the blood of these patients.

The increased severity of the diabetes which practically always results from an infection may manifest itself by elevation of the blood sugar with or without acidosis. Acidosis may be prevented or counteracted in most cases by giving 500 milliliters of 5 per cent glucose containing 25 units of insulin hypodermically every 4 to 6 hours. Of course the glucose may also be given by mouth as orange juice (which is practically a 10 per cent sugar solution) or it may be given by rectum or by vein. Early drainage of the infected area is desirable for even with insulin it may be difficult or impossible to control the diabetic condition in the presence of a severe infection.

After operation the bicarbonate of the blood can usually be restored to a level which is no longer alarming by continuing the glu-

cose and insulin treatment. If the blood alkali remains low in spite of this treatment then sodium bicarbonate may be given intravenously or by rectum in 2 to 3 per cent solution. Overalkalinization which may injure the kidneys and nervous system can be avoided by control of the reaction of the urine and estimation of the bicarbonate content of the blood.

The effect of treatment is best observed by examining each voiding of urine for sugar, diacetic acid and reaction. This is easily accomplished even in private practice with the help of a few pyrex test tubes, a sternal lamp, ferrous chloride, Benedict's qualitative solutions and litmus paper. A few drops of urine suffice for each determination so that the collection of the 24 hour amount is hardly interfered with. Obviously this routine is all the more important when large doses of insulin are required. Hypoglycemia may have a serious effect on a patient already weakened by disease and operation. An amount of insulin which is necessary at one time may become excessive at another when absorption from an infected area is suddenly diminished. Hypoglycemia may also result if food is withheld for too long a time after the administration of insulin on account of anorexia, nausea, vomiting or through error. The so-called insulin or hypoglycemic shock is easily relieved by the administration of sugar by mouth or hypodermically. The daily fluid intake is held between 2 and 4 liters by administering orange juice, water, bouillon

TABLE II—SHOWING THE EFFECT OF PNEUMONIA BACTERÆ IIA AND GANGRINOUS CILIARITIS ON THE CARBOHYDRATE METABOLISM OF A MILD CASE OF DIABETES

Date	Diet			Fluid tak mls.	U in ug gm p d	Blood		Remarks
	Carb gm	P. t. gm	F. t. gm			Sug %	Bacc   %	
Jan					8.4	46	63	Admission
J 2-3	60	5	5		7.6			M temp 4
J 3-4	60	5	5	75	5.7			Max temp
Jan 4-5	60	5	5	80		5	66	Max temp 6
Jan 5-6	6	5	5		5.3			M temp 99.8
Jan 6-7	3	3	3	300	+			M temp 4
J 7-8	3	3	3	90				M temp 4
J 8-9	3	3	3	400			5	M temp 8
J 9-3	3	4	4	300				M temp 4
F b 3-4	3	4	4				63	Operation No 3 m es
F b 5-6	3	4	4	2600			66	M temp
F b 6-7	3	4	4	4000			65	Operation No 37 m es
F b 7-8	3	4		90			65	M temp 99.8
F b 8-9		5	90	3100				M temp 6
F b 9-10								Operation No 45 m t
F b 10-11	4	5		7				M x temp
F b 11-12	7	5						Max temp 99
M 12-13	90	60						M temp 99.4
M 13-14	90	60	5					M temp 98.6

Only figs in col m expressed as per tag

tea and coffee by mouth. If necessary 0.9 per cent saline solution may be given under the skin by rectum or intravenously in addition to the glucose solution. Often any thing but water by mouth may be undesirable for several days after operation.

Acidosis usually subsides within 24 to 48 hours. The further dietary measures and insulin treatment are similar to those employed in uncomplicated diabetes.

Since the advent of insulin it is not uncommon to find more sugar in the blood and urine before breakfast than at any other period during the 24 hours. This is obviously due to the relatively long interval between the evening and morning doses of the hormone. It can be corrected by increasing the evening dose by giving it later or by giving a second dose at about 10 p.m.

Several days before discharge from the hospital the patient or person responsible for the preparation of the diet is instructed in the selection and calculation of the food re-

quirements, the examination of the urine for sugar and diacetic acid and the injection of insulin if that is necessary. Medical and surgical observation is continued in the outpatient department of the hospital.

These infections usually occur in patients who have not given sufficient attention to their diet, their serious nature and prolonged course with the resulting loss of time serve to impress the patient with the need of co-operation and periodic medical examination.

**Gangrene.** During the past 6½ years 23 diabetic patients with gangrene were admitted to the surgical wards. Of these 11 were operated on with 2 deaths, a mortality of 12 per cent which compares favorably with the statistics of several other eastern clinics.

Gangrene is nearly always limited to the lower extremities and usually begins in the toes. In almost every instance arterial changes are present which result in decreased or absent pulsation of the arteries of the foot. If the arteriosclerosis is sufficiently advanced

TABLE III—SHOWING GRADUAL IMPROVEMENT IN CARBOHYDRATE METABOLISM DURING THE HEALING OF AN INFECTED WOUND

Date	Diet			Insulin units	Fluid intake mls.	Urine sugar in hr gm.	Blood		Remarks
	Carb. gm.	Prot. gm.	Fat gm.				Sug. %	Bica. h. volts.	
April 9-16	7	60	5	3			3	3	
April 16-27	7	60	5	3		8			
April 27-13	7	60	5	45		17			
April 13-19	5			60		+++			Operation. Glucose subcutaneously Orange juice by mouth.
April 19-20	5			5	5	8	70	57	Orange juice by mouth.
April 20-21	6			5	5	5	8	5	Vomiting. Mucous. Glucose per rectum.
April 21-22	75			60	35	7.6			Glucose per rectum.
April 22-23	15				00	8.6	65		Glucose subcut. acutely. 2nd per rectum. Dose amount of insulin by mistake.
April 23-24	60	60	60		5				
April 24-25	5			5	20	last			Cereal by mouth. Glucose per rectum.
April 25-26	7				5	8			Vomiting.
April 26-27	44					6			Gruel or orange juice toast.
April 27-28	55	6		40		6.8			
April 28-29	60	60	60			6.1			Regular diabetic diet.
April 29-30	60	60	60						
April 30-	60	60	60	40					
April	60	60	5						
April 2-3	60	60	5	4					
Aug 5-6	80	80	5				3		

\*Diabetic acid never appeared in urine

the roentgenogram of the leg may show linear shadows indicative of calcium deposits in the blood vessels.

Prolonged hyperglycemia is probably responsible or aggravates the arterial changes though this causal relationship has never been conclusively established by experiment. Premortory symptoms and signs of impending gangrene are undue coldness of the feet, pain on walking or during the night when the circulation is at a low ebb, numbness and discoloration of the toes. At this stage benefit may be obtained (usually only after a period of months) by the following measures: rest (partial or complete), the application of dry heat, exercises as advocated by Buerger, (1) massage and restriction of diet with or without insulin according to the severity of the diabetes. Diminished food consumption reduces blood sugar and lowers body weight thus lessening the burden on the lower extremities. Joslin advocates

extreme cleanliness and avoiding abrasions and pressure on the feet. As the ensation in the affected limb is often impaired care must be exercised in the application of heat. An infected blister due to a burn may be the last straw that precipitates the dreaded complication. A safe warm air chamber is improvised by introducing an electric bulb into a space provided by raising the bed clothes over curved flexible wooden splints inserted within the sides of the bed.

Gangrene is most frequently observed in mild diabetics and may occur with only a moderate elevation of blood sugar (for example between 0.15 and 0.2 per cent) and without glycosuria or symptoms suggestive of diabetes. This is one reason for urging periodic medical examinations especially of the urine and blood. Occasionally one finds the blood sugar elevated to 3 or 4 times the normal amount with no sugar in the urine. Seelig (8) reports such a patient who de-

TABLE IV—ACUTE APPENDICITIS AND APPENDICECTOMY IN A FAIRLY SEVERE CASE OF JUVENILE DIABETES

D t 9 4	Diet			Insulin un ts	Fluid int k ml	Urin		Blood		R m k
	Carb gm	P t gm	F t gm			Sug gm	Dia	Sug g	B ls cc	
Mar 8 9	75			45	900		++	0	5	Oper t d po M 7
Ma 9-3	75			7	5	3		36	6	V m ung
M 30-3	75			6	500	8		3	5	V m ung
Mar 3	5	5	00	75	5		++	35	63	8 gm nd b ca b p
Apr -2	5	5	00	4	3500	5		7	58	3 feed gnt
Apr 2-3	5	5	5	65	00	9		5	54	
Apr 3 4	5	5	5	7	4 5	6 8			44	
Apr 4 5	5	5	5	60	55	tr			6	
Apr 5-6	5	5	5	5	35	3 3				
Apr 6-7	5	5	5	5	35	4 8				R gul d bet d t
Apr 7-8	5	5	5	5	7					
Apr 8-9	5	5	5	5	5			8	5	
Apr 9-	5	5	5	5	00			6	53	
Apr 3 4	5	5	5	5	5			7		

\*Gl cose hypod rmatically

†Feedings ns ted f milk ra g juice gg d milk t ast

veloped diabetic coma after colostomy under local anaesthesia. This author also advocates the use of glucose and insulin as a prophylactic measure before operation.

Usually death and marked discoloration of the tissues have occurred when the patient seeks hospital care. Mortification may be slow, the gangrenous area circumscribed, dry, even mummified, or it may be rapid with extensive infection as evidenced by fever, swelling, redness, tenderness, inflamed lymphatics extending up the leg and painful enlarged inguinal nodes associated with hyperglycaemia, glycosuria and acidosis. In the latter case early amputation is usually required.

Occasionally patients with heart weakness develop thrombosis of the larger arteries with loss of blood supply to the entire leg in a relatively short time. The surgeon may have difficulty in selecting the optimum site of removal. Usually the question arises whether to amputate above or below the knee joint. The important criteria are age, economic status, likelihood of viability of the stump and presence of bacteria at the site of amputation. The blood supply of the tissues at the level of amputation may be impoverished as

a result of disease of the smaller vessels even though there is good pulsation in the popliteal and femoral arteries. The stump often becomes infected in spite of precautions or is allowed to heal by granulation from the outset. This is a notoriously slow process in diabetic patients. A second operation consisting in loosening of the flaps and the application of traction may be necessary to enclose the end of the bone and secure proper healing.

In infected cases acidosis may become alarming so that glucose and insulin may be required before operation. After operation from 600 to 1000 milliliters of orange juice may be administered during the course of the day. If nausea or vomiting are present 250 milliliters of 5 per cent glucose solution may be given by rectum every 3 to 4 hours. The total volume of fluid range between 2 and 4000 milliliters per day depending on age, condition of the circulation and the degree of acidosis. Insulin if required can be given  $\frac{1}{2}$  hour before each sugar administration.

As soon as acidosis, nausea and vomiting have subsided, cereals, toast, soft cooked eggs, milk and junket are added. Later the



TABLE V—ILLUSTRATING THE USE OF GLUCOSE AND INSULIN TO PREVENT ACIDOSIS FOLLOWING APPENDICECTOMY FOR ACUTE APPENDICITIS IN A MODERATELY SEVERE CASE OF DIABETES

D.	Diet			Flin 1 total mls	Insulin unit	Urea		Blood		Remarks
	Carb gm	Prot. gm	Fat gm			mg	1 sec 1	mg	Farb mls	
July 10	3							3	47	Edema of legs, during op.
July 11						+++	+			5 hours of surgery
July 12						++	+			4 hours of surgery
July 13						+				hours of surgery
July 14	3			00			+			
July 15	44	3					+++			On new diet, 100 mg. insulin
July 16	6	3		1500			+			
July 17-18	64	3								
July 19-21		9	26							
July 22	0	8	26							
Aug 1	94	3	3	2500						
Aug 2	94	3	26	2500				7		
Aug 3-4	60	60	3	00						Urea clear test.
Aug 5-8	60	60	15	250						

\*Glucose subcutaneously

patient: given the regular meals consisting of the usual diabetic foods. The quantity of carbohydrate, protein, and fat is determined by the patient's tolerance and state of nutrition. Needless to say, the co-operation of skilled dietitians is desirable; the daily examination of the 24-hour urine for glucose and diacetic acid, and the examination of the blood for sugar and bicarbonate are essential for intelligent supervision. Usually there is no difficulty in clearing up the urine. We have seldom succeeded in maintaining the fasting blood sugar at a normal level throughout the healing process, even with fairly sized doses of insulin amounting to 100 units per day in some instances. The advisability of giving larger doses of insulin was frequently considered. On account of the danger of hypoglycemia, it was always decided to give the more reasonable quantities unless grave acidosis was present. In most cases the blood sugar content can be kept in the neighborhood of 0.5 per cent or lower.

If the patient is overweight, the take may be increased to from 100 to 200 cal.

hydrate 60 to 100 grams of protein and 100 grams of fat may be given. Loss of excess weight is especially desirable to diminish the burden on the remaining limb, the arteries of which are almost certainly sclerosed though perhaps not as markedly as in the amputated limb.

**Accidental surgical complications.** In cases of acute appendicitis, intestinal obstruction, perforated duodenal ulcer, acute myocarditis, etc., when there is little time for reduction of acidosis and blood sugar, the administration of glucose and insulin hypodermically before, during, or shortly after operation should become a routine procedure in the majority of instances. These patients receive nothing by mouth or only sips of water for from 1 to 3 days after operation. Feeding is begun with cereals, orange juice, tea, and later toast, soft cooked eggs, milk and junket are added. Anorexia, nausea, vomiting, fever, abdominal distention or ileus may delay exhibition of foods for varying lengths of

During these trying periods the administered glucose and insulin combination procedure. In ab-

TABLE VI—SHOWING THE ACTION OF INSULIN ON ACIDOSIS COMPLICATING EAR INFECTION

D 93	Time	Fluid intake ml	Insulin units	Urea		Blood		Remarks
				Sugar h gm	D t	Sugar	Esca b l	
J 7	3 p.m.					30	5	Hyperpnea
	3.3 p.m.		5					
	6.3 p.m.						5	Praetibintr drums gms sod
	5 p.m.	700	37	47	++++			
J 8	7.00 a.m.					5	6.6	
	10.00 a.m.		5					
	10.00 p.m.					44	7	
	3.00 p.m.		5					
	6.3 p.m.		5					
	8.00 p.m.	7900		73	++++	8	57	Hypertrodisgmsdb
J 9	3 a.m.	4500						
J		8300		44	++++	44		Sodibbottsgmstasly

dominal infections one must be on guard to combat acidosis which may develop precipitately and without warning

During convalescence from stomach operations it does not seem wise to withhold the more easily digestible carbohydrate foods such as gruels, toast and baked mashed potato even if the dose of insulin must be raised proportionately. In most instances a diet better adjusted to the metabolic defect can be substituted in a relatively short time.

Sooner or later the daily allowance of carbohydrate, protein and fat is divided into the usual 3 meals consisting of weighed amounts of fruit, bread or substitute, milk, cream, butter, meat, eggs, vegetables and cheese.

If operations can be deferred as in simple hernia, hemorrhoids, chronic appendicitis, etc., then it is usually possible to clear the urine of glucose and diacetic acid several days before operation. If the operative procedure requires prolonged ether anaesthesia, then glucose and insulin may be administered during the operation and during the immediate postoperative period.

In conclusion it may be of interest to discuss briefly the use of insulin in non-diabetic surgical patients. There appears to be no valid objection to the injection of any

reasonable quantity of insulin provided it is accompanied by the required amount of glucose. We have given it subcutaneously without untoward results in the proportion of one unit of insulin for each gram of glucose for the acidosis of starvation whatever the cause and to insure the rapid oxidation of glucose in kidney insufficiency and in post-operation prostration or shock.

The following data referring to individual patients serves to illustrate and validate the statements preceding. The urine specimens were collected in 24 hour periods from 7 a.m. to 7 a.m.

The relative concentrations of diacetic acid and (in some cases) sugar in the urine are expressed in terms of plus signs + being the minimum and +++++ the maximum reaction.

CASE 1. The effect of lobar pneumonia, bacteraemia and gangrenous cellulitis of the leg on the carbohydrate metabolism of a mild case of diabetes.

J. W. age 43 years No. 56103 was admitted to the hospital January 2, 1923, discharged May 11, 1923. He had suffered with diabetes and ulcer of the leg for 5 years. He had used no dietary restriction. He showed the signs and symptoms of lobar pneumonia, group 1 pneumococcus in the blood and an extensive gangrenous ulceration of the left leg. On entering the hospital his temperature was 104 degrees, pulse 120, respirations 36, leucocytes in blood 42,000. Four hundred milliliters of anti-

TABLE VII—SHOWING THE BEHAVIOR OF A CASE OF SEVERE DIABETES COMPLICATED BY CELLULITIS AND INSULIN SHOCK

D.	Food			Insulin	Urine		Blood		Temp.	Remarks
	Cals.	Prot. gm.	Fat gm.		ug. gm. h.	Specific	Glucose	Bilirubin		
Feb 5					+++	+++	9	24		
Feb 6-7	3	3	3	5	8	+	0		100.8	Facial edema
Feb 8	3	3	3		38	+			100	Swelling of lower
Feb 9	3	3	3		35				100	extremities
Feb 10	3	3	3	5	65	+	5		100.6	
Feb 11	3	3	3		54	+			100	
Feb 12	3	3	3		5	++++			100	
Feb 13	3	3	3	5		+	5		100.6	
Feb 14	3	3	30		1	+			100.8	
Feb 15-16	3	3			3	+				
Feb 17		3				+++			100	
Feb 18		3	3		90	+++	5		100	
Feb 19					7	+++			100	
Mar 1					85	++++			101.8	
Mar 2					3	++++	6	1		Facial edema
Mar 3	3					+++				lower
Mar 4			30	20	7	+++	5	1	100.8	
Mar 5-6	3				37	+++			100	
Mar 6-7		3		20		++			100	
Mar 7-8	30	30				++				
Mar 8-9	3		3						100.6	
Mar 10									100.6	
Mar 11	3		3						100.6	W. 2 p.m. h. of swell- ing on lower extremities
Mar 12					7					Another attack of swelling
Mar 13				20					100.8	of lower
Mar 14										
Mar 15	3		30		8	+				
Mar 16		3			7	+			100.6	
Mar 17	7		3		3				100.6	2nd operation on knee joint
Mar 18									100.6	1st stage

In 1906 ox serum was given intravenously. In 1911 the most painful leg was amputated. In 1912 the left leg became necessary on account of an infection of the knee joint.

The high blood sugar and glycosuria on a few occasions were somewhat misleading. Table II shows that the ability to burn carbohydrate was definitely impaired in spite of severe pneumonia with latent cellulitis and

purulent arthritis of the knee joint requiring amputation through the thigh. Note the normal blood sugar during convalescence on a diet of 100 grams of carbohydrate (50 of protein and 50 of fat). Diabetic acid was absent throughout and insulin was not required. Three operations including amputation were done and recovery was complete without acidosis. The slow healing of the stump was

TABLE VIII—SHOWING ALMOST COMPLETE ABSENCE OF REFRACTION IN A MILD DIABETIC AFTER OPERATION FOR INCUBAL HERNIA UNDER LOCAL ANESTHESIA

D	Diet			Fasting ml	U		Blood		Remarks
	C b gm	P t gm	F t gm		Sug gm	D	S g	B b J	
Dec					—				
Dec 5	3	3	3	7			99	49	
Dec 5-6	3	3	3			++			Operat
Dec 6-7	3	3		7					
Dec 7-8	3	3	3	300		+			
Dec 8-9	3	3	3					5	
Dec 9-10	3	3	3						

the cause of the prolonged stay in the hospital

CASE 2 Gradual improvement in carbohydrate metabolism during the healing of an infected stump wound following amputation of the leg for gangrene of the foot

Man age 6 years No 51644 was admitted April 8 1924 and discharged August 15 1924. He was an alcoholic with a history of diabetes for 14 years. He had been in hospital three times previously. He was discharged one month ago on 30 units of insulin and a diet consisting of 60 grams of carbohydrate 60 of protein and 150 of fat. His blood pressure was 180/90. He showed evidences of marked arteriosclerosis. Patient gradually developed a purplish area at the base of the little toe and a bluish black bl on the medial aspect of the big toe. Amputation as done through the upper third of leg under ethylene anesthesia lasting 8 minutes. He had an infection of the stump. Healing was prolonged with necrosis of the end of the tibia. Loosening of flap and traction was required to cover the end of the stump. Patient suffered with hicough and vomiting for 6 days after operation.

During the remaining 3 months of his stay in hospital the urine remained sugar free. The diet was gradually increased to 80 grams of carbohydrate 80 grams of protein and 150 gram of fat. Insulin was decreased to 1 unit each day. Blood sugar on discharge (August 15) as 0.13 per cent.

CASE 3 Acute appendicitis and appendectomy in a moderately severe case of juvenile diabetes

Girl age 2 No 5950 weight 118 pounds was admitted to hospital March 27 1924 and discharged April 7 1924. She had had diabetes for 2 years. Diet before operation consisted of 40 grams of carbohydrate 60 gm of protein and 120 grams of fat 18 units of insulin per day. Last fasting blood sugar before operation was 0.22 per cent. The signs and symptoms of acute appendicitis appeared during the 4 hours preceding admission to hospital. Temperature on

admission was 102 degree pulse 124 leucocytes 31,000. Appendectomy was performed on the night of admission. Ether anesthesia was used (45 minutes).

The severity of the diabetic condition the intra abdominal infection the operation and ether anesthesia were the factors responsible for the acidosis. The prompt effect of sodium bicarbonate administration in raising the alkaline reserve of the blood is noteworthy.

The severity of the diabetic condition is indicated by the fact that the patient required 50 units of insulin daily to keep the blood sugar down at the time of discharge when the wound was completely healed.

CASE 4 Acute appendicitis and appendectomy in a moderately severe diabetic

Unveritt instructor age 33 No 57591 was admitted to hospital July 25 1923 and discharged August 1 1923. He suffered with a moderately severe case of diabetes of 3 years duration. This was controlled by intelligent diet restriction. Symptoms of appendicitis began with pain in the right lower quadrant of the abdomen nausea and vomiting for about 24 hours preceding admission. Operation as done on July 25 under nitrous oxide oxygen anesthesia lasting 50 minutes.

The gradual disappearance of glucose and diacetic acid from the urine in the period immediately following operation was probably due to the glucose and insulin administration.

CASE 5 Acute otitis media mastoiditis acidosis coma and death

L D girl age 23 No 56057 weight 121 pounds height 5 feet 3 inches was admitted January 17 1923 and died January 21 1923. This was a neglected case of diabetes of 4 years duration. She had had



TABLE V.—PREVENTION OF SEVERE ACIDOSIS BY MEANS OF INSULIN AND GLUCOSE ADMINISTERED BEFORE OPERATION

D t 9 4	D t			I un is	Fluid tak mls	Un		Blood		R mark
	C b gm	P gm	F t gm			Su gm	D	S <sub>e</sub>	B <sub>i</sub> b <sub>o</sub>	
F b 8-9										
F b 9-	7	6	75					00		
F b 4 5	7	60	75		900		+			
F b 6-7	5					36	++++			Ope tio t g m
F b 7 8	7				3		+++			V mited 4 tun
F b 8-9	7						++++	9	4	
F b 9-2	7	6	75		8	+	++++			
F b	7	6	75							
F b -75	7	60	75		5	83	+++	5		
F b 8 9	7	6	75							
M 8-9	7	6	7		5			5		
M 8-9	7	6	75					3		

\*Glucose dissolved in 100 m Operative m test Labeled man  
N tr us and yg d th zes besu

had become sugar free on 40 grams of carbohydrate, 50 grams of protein and 120 grams of fat. She was operated upon for repair of right femoral hernia under local anaesthesia.

The operation which lasted 1 hour was done under local anaesthesia at 1 p.m. the patient not having received breakfast or luncheon. The acidosis was easily controlled by repeated small doses of glucose given by mouth subcutaneously and by rectum accompanied or preceded by small doses of insulin. Later insulin could be omitted entirely though the diet was increased to 75 grams of carbohydrate, 60 of protein and 175 of fat. The severe acidosis might have been avoided had the glucose and insulin been given before operation as is customary now.

The patient had a recurrence of the hernia and was operated upon about 1 year later with the results shown in Table V.

Although the second operation required 94 minutes and was performed under ether and nitrous oxide anaesthesia it was possible to prevent severe acidosis by the prophylactic

lactic use of glucose and insulin. The lengthy stay in the hospital was occasioned by an infection of the herniotomy wound.

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# FLUOROSCOPIC OBSERVATIONS ON THE EFFECT OF DUODENOBILIARY DRAINAGE ON THE VISUALIZED GALL BLADDER

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**F**OLLOWING the experiments recently published in our preliminary report (1) we have made further studies of the visualized gall bladder before and after non-surgical biliary drainage with the introduction of magnesium sulphate solution directly into the duodenum (Evan Meltzer technique). In the original work it was noted that the gall bladder shadow resulting from the intravenous injection of the sodium salt of tetra bromophenolphthalein (Crisham method) was reduced in size and altered in shape by a single instillation of magnesium sulphate solution into the duodenum followed by biliary drainage. This reduction in size of the gall bladder shadow was slight but quite distinct after a single dose of the salt solution and then drainage.

We have extended our experiments to other patients in an effort to determine if re-

peated injection of magnesium sulphate solution into the duodenum would produce more complete drainage of the gall bladder visualized at intervals during the biliary drainages. It was observed that the gall bladder was reduced in size until there was almost a complete disappearance of its shadow within a comparatively short period of time. We have used the same roentgen ray technique as that described in the preliminary report (1).

Crisham, Cole and Copher's (2) interpretation of the normal gall bladder is based upon the following findings. Usually at about the fourth to the seventh hour after the injection a faint but definite outline of the gall bladder appears which is seen to have the contour of the normally shaped organ but to be somewhat larger than normal gall bladder usually seen at laparotomy. At the end of 24 hours the shadow is much more distinct but con-

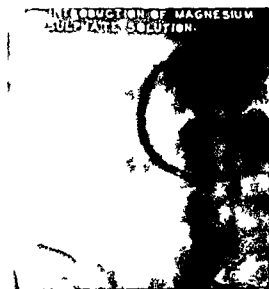


Fig. 1. Cris. Roentg. gram. I. g. t. g. l. l. l. d. l. l. h. u. r. s. f. r. t. i. t. r. a. n. s. j. t. n. f. t. h. l. m. l. t. f. t. t. a. l. m. p. h. l. p. h. l. m. m. l. v. t. y. b. e. t. t. h. t. r. o. d. t. n. t. h. r. u. g. h. a. t. b. e. f. m. g. n. m. u. l. t. i. s. o. l. u. t. i. o. n.

I. g. C. s. e. (U. S. A. l. l. b. l. w. a. f. t. r. s. t. m. l. t. f. m. g. s. u. l. p. h. t. e. s. o. l. t. i. d. r. a. g. e. e. r. f. l. l. h. (O. p. e. t. e. d. a. g. n. o. s. b. r. o. h. i. l. y. s. t. u. ) N. e. t. h. m. a. r. k. d. r. l. t. i. n. n. s. f. t. h. g. a. l. l. b. l. d. e. r. h. t. w.

I. m. b. l. p. a. m. f. m. l. D. l. o. f. c. i. f. m. l. i. l. r. d. o. s. e. T. i. t. e. n. y. f. l. o. T. h. t. h. a. c. c. o. l. f. p. h. l. m. t. h. l. e. d. i. l. l. a. t. i. o. n.



Fig 3 Case Gall bladder shadow 2 hours after injection of tetrabromphenolphthalein solution immediately before introduction of magnesium sulphate solution Tube in second dorsal position of duodenum



Fig 4 Case Gall bladder shadow 15 hours after fast and 15 minutes after injection of magnesium sulphate solution and drainage over a period of 1 hour Note the decrease in size of the gall bladder

tracted down to only about one half of its earlier size. It has also been our experience that the normal gall bladder will require from 16 to 20 hours to reduce itself one half.

A pathological gall bladder shadow visualized 12 hours after the injection of 5.5 grams of the sodium salt of tetrabromphenolphthalein was reduced in size 50 per cent within 1 hour. This was accomplished by the introduction of magnesium sulphate solution directly into the duodenum at 20 minute intervals followed by duodenobiliary drainages (Case 1).

In another individual the gall bladder shadow was reduced in size approximately 50 per cent within a period of 2 hours. This result was obtained by drainages following 4 injections into the duodenum of magnesium sulphate solution (Case 2).

#### REPORT OF EXPERIMENTS

CASE 1 F H F white male age 35 examined July 19, 1924 complained of soreness in the upper abdomen with a burning sensation. The area was tender on pressure in the epigastrium. August 20, 1924 5.5 grams of the sodium salt of tetrabromphenolphthalein was injected intravenously in two equal doses at 8:30 and 9:20 a.m. respectively after

a fast of 15 hours. The duodenal tube was introduced at 6 p.m. and the gall bladder visualized after the tube had entered the second portion of the duodenum at 9:15 p.m. (Fig 1). Immediately following 50 cubic centimeters of a 5 per cent solution of magnesium sulphate was introduced through the tube into the duodenum. After a lapse of 8 minutes duodenobiliary drainage was allowed to take place for 1 hour. Then an additional 50 cubic centimeters of the same magnesium sulphate solution was introduced into the duodenum and followed by biliary drainage for 1 hour. At 10:30 p.m. the second roentgenogram (Fig 2) was taken and showed a reduction in size of 50 per cent. October 14, 1924 the patient was operated on and the gall bladder was removed because of evident pericholecystitis. The histological diagnosis was chronic cholecystitis.

CASE 2 P P white male age 32 seen August 26, 1924 complained of periodic attacks of abdominal disturbances and headache. The liver was palpable. The duodenobiliary contents contained numerous pus cells.

August 31, 1924 5.5 grams of the sodium salt of tetrabromphenolphthalein was injected intravenously in two equal doses at 8 and 8:30 p.m. respectively after a fast of 10 hours. At 10 a.m. the next morning the gall bladder was visualized (Fig 3) with the tube in the second portion of the duodenum. Immediately following 50 cubic centimeters of a 25 per cent solution of magnesium sulphate was introduced through the tube into the duodenum. After a lapse of 8 minutes biliary drainage through





Fig 5 Case Gall bladder shadow following administration of magnesium sulphate solution and drainage over a period of 2 hours Note the marked reduction in size of the gall bladder

the tube was allowed to take place for 20 minutes. This was followed by a similar dose of the salt solution and drainage for an additional 20 minutes. Another roentgenogram (Fig 4) was made immediately

following this 50 cubic centimeters of the magnesium sulphate solution was introduced. After 8 minutes duodenobiliary drainage was allowed to take place for 20 minutes. Then the last or fourth dose of 50 cubic centimeters of the magnesium sulphate solution was introduced through the tube. After a lapse of 8 minutes biliary drainage was instituted for 20 minutes more. A roentgenogram (Fig 5) was made and it demonstrated the persistent reduction in size of the gall bladder as a result of repeated injections of magnesium sulphate solution followed by duodenobiliary drainages.

### CONCLUSIONS

1. The duodenobiliary drainages with repeated injections of magnesium sulphate solution have produced decided reduction in the size of the gall bladder shadow visualized by the intravenous injection of the sodium salt of tetrabromphenolphthalein.
2. The gall bladder is more completely drained by repeated stimulations of the duodenal mucosa with magnesium sulphate solution.

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FRACTURES OF THE LOWER END OF THE RADIUS<sup>1</sup>

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FOR some time past I have been especially interested in the study of fractures of the lower end of the radius being impelled thereto by several considerations. In the first place fractures in this situation are undoubtedly among the most frequent with which the general practitioner has to deal. While the actual figures in various compilations of statistics may vary somewhat as to percentage a careful consideration of any large series of fractures in general will show that those of the radius at the so called typical situation come very close to the head of the list as regards frequency. According to Bardenheuer (2) typical fracture of the radius takes first place in frequency among all fractures according to Dupuytren (8) Hoffa (14) and Storp (40) it constitutes 10 per cent of all fractures according to Bruns (5) 18 per cent. Plagemann's statistics (32) based upon 1,393 fractures all confirmed by roentgenogram give it a percentage of 5.74 which is exceeded only by fracture of the shaft of the tibia and fibula with a percentage of 6.604.

Since it is so common and so well known to all of us under the usual name of Colles' fracture it would naturally seem that the treatment of the condition should be fairly well standardized and the results uniformly good but such is far from being the case. We can all recall cases we have treated in which the wrist is left permanently stiff and swollen with loss of flexion and extension weakened grip in the fingers tendon adhesions etc.—in short a hand and wrist which is permanently crippled. And this too in the case of a simple fracture with no marked displacement or associated injuries.

This is not due to lack of knowledge on the part of the surgeon in charge of the case but to a disregard of certain factors which are absolutely essential to complete anatomical and functional restoration. In truth in view of the fact that they are so common it would seem that more or less familiarity has a tend-

ency to breed a certain amount of contempt and that very often these fractures are not accorded the careful and painstaking attention that they deserve.

In the vast majority of cases with proper treatment complete anatomical and functional restoration may confidently be expected with improper or with *incomplete* treatment a greater or less degree of permanent disability is the result. It is not sufficient to reduce the fracture and apply a circular cast for in such cases even though the fracture is a simple one with no apparent complications and with perfect reduction of the fragments the result will certainly leave much to be desired as there cannot fail to be some limitation of motion in the wrist joint which will be permanent to a certain degree.

No patient should be put into the permanently crippled class when this can be avoided even though the crippling is slight and the effect of it may be overcome by adaptation. It is simply an additional handicap in the struggle for existence which at best is hard enough for the average normal individual. A fracture of this kind practically always occurs during the period of greatest activity and permanent disability usually means lessened earning power. Since many of these cases occur in industry the broader aspect of the economic loss to society which is large in the aggregate must also be taken into consideration. Today with workmen's compensation laws so generally in force all employers of labor carry insurance. Any permanent disability is paid for by the insurance company which passes the cost on to the employer who in turn passes it on to the consumer in the price of his product so that ultimately society at large pays the bill. Improvement of the end results in the treatment of industrial accidents will naturally reduce this bill.

Any improvement in the end results of fracture of the lower end of the radius can only be brought about by careful and pains-

taking attention to details in treatment and in order to carry out this treatment intelligently or in fact the treatment of any condition a clear knowledge of the why and where fore the rationale in other words is necessary in this particular instance we should endeavor to understand the usual mechanism by which the fracture is produced

Reduction is effected by reversing the mechanism. In the after treatment massage and passive motion stand out prominently. If these are conscientiously carried out after complete reduction of the fracture excellent results with practically no permanent disability are the rule.

In addition to these practical considerations this fracture is of great academic interest. It is nearly always produced by indirect violence in fact I do not believe that a fracture in this situation could be produced by direct violence alone except in the case of crushing injury. There are only two main exciting causes falls on the outstretched arm and hand which account for the great majority of cases and kicks from back firing gas engines which give rise to a smaller number. Conversely it is true that either of these causes if it produces a fracture at all always produces a fracture of the radius at the typical site it does not produce a fracture of the ulna or of the shaft of either bone or an injury to the elbow or shoulder in certain instances. Such being the case it follows that the same combination of forces or combinations of forces having the same effect must always be active preceding during and following the fracture of the bone since a given effect must be produced by a given cause. This gives rise to some questions the solution of which would be interesting. For example what are the forces concerned? What is their method of transmission? Why does the radius fracture at what is apparently its thickest part instead of at the comparatively more fragile neck? There are a few of the questions which have given rise to a great deal of discussion for the better part of a century and the answer constitutes the explanation of the mechanism of the fracture.

For the purposes of this investigation in addition to a review of my own records I

have studied over 100 roentgenograms of fractures of the wrist very kindly placed at my disposal by St Vincent's Hospital of this city and have endeavored to cover thoroughly the literature on the subject especially the more extensive contributions.

#### OCCURRENCE AND ETIOLOGY

Bony injuries at the lower end of the radius may be divided conveniently into three classes namely (1) epiphyseal separations (2) incomplete fractures or fissures and (3) complete fractures. With the first two classes we are not particularly concerned in this paper which deals with true fractures of the lower end of the radius. However it may be stated here that epiphyseal separations occur in youth before union of the epiphysis has taken place this union ordinarily being completed by the twentieth year of life. They correspond to the typical fracture of adult life and are presumably produced by the same mechanism. According to Vogt and Bruns (45) they may be divided into chondro-epiphyseal separations and osteo-epiphyseal separations. In the former as the name implies the separation takes place through the proximal portion of the epiphyseal cartilage occurs in childhood and is relatively and absolutely infrequent in the latter the separation takes place through the extreme distal bony portion of the diaphysis occurs in later childhood and youth is very common following falls upon the hand and corresponds to the adult fracture.

Incomplete or fissured fractures follow the long axis of the bone are rare and are frequently overlooked.

Complete fractures of the lower end of the radius are ordinarily spoken of as Colles' fractures but is a matter of fact this term is not strictly accurate. The fracture described by this surgeon is about 1 1/2 inches above the lower articular surface and except as a result of direct violence is very rarely met with. The site of the typical fracture lies much nearer the carpus and measuring from the carpal articular surface is given by various authors as follows (see Kahley, 35, 17)

A report of 15 cases of Colles' fracture

Colles	40 millimeters
Hamilton	7 to 40 millimeters
Drake	15 to 30 millimeters
Koenig	10 to 30 millimeters
McDermott	20 to 25 millimeters
Dupuytren	7 to 25 millimeters
Smith	6 to 25 millimeters
Hill	0 to 20 millimeters
Linnhart	13 millimeters
Nélaton	9 to 11 millimeters
Alibert	5 to 10 millimeters

Bardenheuer gave the site as 8 millimeters anterior to 16 millimeters posterior to and 26 millimeters above the tip of the radial styloid. As may be seen the limits vary somewhat and depend upon from what side the fracture is viewed and also upon the direction of the line of fracture. Briefly it may be said that the typical fracture of the lower end of the radius is a more or less transverse one in the vicinity of the junction of the epiphysis and diaphysis that is within one half to three quarters of an inch or 10 to 20 millimeters of the lower articular surface. It is frequently accompanied by injuries to associated structures the complication oftenest present being fracture of the ulnar styloid and more rarely fracture of some of the carpal bones.

Typical fracture of the radius is almost exclusively confined to adult life that is it is very exceptional to find it before union of the lower epiphysis has occurred. This union takes place usually about the nineteenth or twentieth year of life. Previous to this we find either a separation of the epiphysis or a fracture of the shaft of the bone. According to Hoffa (14) the fracture occurs most frequently between the ages of 50 and 60 next in the fourth decennium and least often in the second and third.

It occurs more frequently in women than in men a fact which is difficult of satisfactory explanation unless on the basis of greater fragility of bone. According to Morris (26) of 169 fractures 114 were in women and 55 in men according to Krantz (19) of 43 fractures 157 were in women and 86 in men. Since more men than women are engaged in industry this seems to show that as an industrial accident the fracture is not very frequent.

The exciting cause is practically always in direct violence as was stated previously. It

usually results from a fall upon the outstretched arm with the hand in a position of pronation and the wrist more or less hyperextended. With the widespread use of the gasoline motor in recent years an additional source of indirect violence has been introduced namely the kick of a motor back firing while it is being cranked.

#### ANATOMY

Before proceeding to a discussion of the mechanism by which these fractures are produced it is desirable to review briefly the general features of the anatomy of the parts concerned including the forearm and elbow joint. Time will not permit me nor is it at all necessary to enter into an exhaustive description of these parts. Various authors have laid marked emphasis on certain anatomical structures for the purpose of supporting different theories of mechanism and these will be indicated as we proceed.

Taking the various parts of the forearm from above downward we come first to the elbow joint. It might seem like going rather far afield to consider the structure of this joint in a paper on fractures of the lower end of the radius but it is necessary for through this articulation is transmitted one of the forces active in producing the fracture namely the weight of the body in falls upon the arm and hand. Three bones enter into the formation of the joint the lower extremities of the humerus and the upper extremities of the radius and ulna.

The upper extremity of the ulna resembles a half closed hand the coronoid process corresponding to the thumb and the olecranon to the fingers (Hennequin 13). These embrace the trochlea of the humerus which presents a groove to receive the blunt ridge extending from the coronoid to the olecranon and dividing the sigmoid cavity of the ulna into two concave facets which are in immediate contact with the faces of the trochlea of the humerus. The ulna is thus directly continuous with the humerus and on this account in falls upon the hand or wrist any force of impulsion is mainly transmitted from the former to the latter and vice versa. Likewise from the nature of the articulation

the ulna is mainly concerned with the movements of flexion and extension.

When we examine the upper extremity of the radius we find conditions considerably different. While the head of the bone articulates with the humerus nevertheless this contact is not nearly so close as that of the ulna except in flexion at a right angle its articulating surface is a very small compared to that of the ulna. On the other hand it has a much more intimate articulation with the lesser sigmoid cavity of the latter bone. As a result of this the humeroradial articulation plays a more or less passive rôle in flexion and extension but together with the radio-ulnar joint is almost exclusively useful in pronation and supination.

Let it be particularly noted that the most intimate contact between forearm and upper arm is between humerus and ulna force being thus mainly transmitted through the latter bone instead of through the radius.

The joint is enclosed by a strong fibrous capsule and is additionally strengthened by anterior and posterior internal and external ligaments.

Next for consideration is the forearm whose skeleton is composed of two bones the radius and ulna. Placed as they are between the humerus and the wrist connected by numerous and powerful ligaments their middle portions bound together by the interosseous ligament or membrane they are rendered so solid that they may almost be considered as one bone except in the movements of pronation and supination which are a function of the radius alone.

The ulna shows two curvatures (De tot and Galloway) a large one with the convexity outward and a lesser one at the lower part with the convexity directed posteriorly. To this latter curvature some authors have attached great importance in the localization of fractures at the lower end of the bone believing that it becomes exaggerated under compression as occurs in falls upon the wrist and thus following a known law fracture takes place from behind forward at point of tension rather than that of compression.

The ulna likewise shows two curvatures giving it the form of an elongated letter S

a superior convexity on the side of the radius and an inferior convexity on the inner side. The latter coincides with the weaker part of the bone. Any force acting parallel to the axis tends to exaggerate these curves and acts maximally upon the inferior convexity.

As has been previously shown it articulates solidly above with the humerus below it is separated from the cuneiform bone of the carpus by the triangular ligament or triangular articular fibrocartilage. It is not so long as the radius by 4 millimeters if the olecranon process and styloid of the radius are not considered (?). For this reason ordinarily it does not fracture at the same time as the radius. According to Bros and a wedge 1 centimeter in thickness must be placed under the hypothenar eminence to break both bones simultaneously. Therefore in actual clinical fracture impaction of the radius must be considerable before fracture of the ulna occurs. The hypothenar eminence is on a higher plane than the thenar consequently it is less exposed.

The interosseous ligament is the most powerful feature of union between the bones of the forearm. Slight at the extremities the middle portion is made up of numerous strong and resistant fibers running obliquely from above downward and from outside in from radius to ulna. These fibers insert themselves on the sharp edges of the two bones. The ligament terminates at the level of the inferior radio-ulnar articulation. It maintains the solidity of the two bones by combining shocks keeps them at their usual distance by preventing exaggeration of their lateral curvatures and possibly has a rôle in the transmission of force from humerus to radius (Hennequin 13).

The lower extremity of the radius is made up of porous or cancellous tissue and is restrained anteriorly and posteriorly by the neighboring tendons. However on its external surface it is very accessible and by the separation of the diaphyseal plates it broadens out in giving rise to an articular surface enlarged transversely irregularly elliptical upon which are two faces separated by a crest one internal irregularly spherical the other triangular at the lowest point descending under

the styloid. This articular surface looks for ward and inward and the posterior lip descends lower than the anterior. As a result of this disposition the axis of the forearm is not directly prolonged with that of the hand but forms with the latter an angle opened internally. Prolonged the axis of the forearm would cut the index finger while that of the hand would strike about the middle of the external aspect of the forearm. The radial styloid descends much lower than the ulnar. As a result of the obliquity of the transverse axis of the radio ulnar articulation it may be seen that in extension as in flexion the hand will be drawn away from the radial side. The radiocarpal articular surface is thus differently constituted at its inner and outer parts and the radius alone is in direct contact with the os naviculare and semilunare it is by means of these two bones that the entire transmission of force from carpus to radius takes place.

The principal feature of the union between the inferior extremities of the radius and ulna is the triangular ligament. Running almost horizontally it is inserted by its base to the inferior border of the lesser sigmoid cavity of the radius by its summit to the articular facet and styloid process of the ulna. Viewed from its distal surface it is seen to prolong the articular surface of the radius and to separate the terminal facet of the ulna from the carpal semilunar and cuneiform.

Turning now to the carpal side of the articulation we find a condyle to be made up of the navicular semilunar and cuneiform bones. The latter takes only an insignificant part being situated on its inner side on a much lower plane. The cartilaginous covering of the condyle extends more on the posterior surfaces of the navicular and semilunar bone than on the anterior.

A joint capsule is present but the real means of union are the anterior and posterior and the internal and external lateral ligament. Close contact is also assured by the muscles and tendons of the forearm.

On account of the importance of the anterior radiocarpal ligament in the mechanism of this fracture a few additional details are necessary. It is made up of three sets of

fibers according to Pilcher (31) having their point of origin on the anterior surface of the os naviculare and semilunar and cuneiform bones. The first set of fibers is the strongest portion of the ligament they pass obliquely outward and become inserted in the styloid process and adjoining anterior margin of the radius. The second set is also a strong band and passes obliquely in the opposite direction to be inserted into the styloid and anterior margin of the ulna. The third set consists of a broad and less dense band passing directly upward to insert into the greater part of the anterior margin of the radius.

The inferior articular surfaces of the first row of carpal bones unite with those of the second row to form the mediocarpal articulations. Between these cartilage covered surfaces the bones present rough superior and inferior surfaces for the attachment of ligaments. The lateral faces are designed for the interosseous articulations except the external face of the os naviculare which rolls under the radial epiphysis. The first row is very mobile in the radiocarpal articulation less so in the mediocarpal by reason of its irregularity and also as a result of the position of the center of rotation. The second row forms with the metacarpus an almost immobile block. A study of the ligaments implies an almost perfect solidarity in the entire bony mass (Destot and Gallois ?)

#### MECHANISM

Having thus reviewed the anatomy of the parts concerned let us now take up for consideration the mechanism of production of fractures at the lower end of the radius. This question has been under discussion for years and a voluminous literature on the subject has arisen. From a fairly extensive survey of this literature from the study of X rays and from reasoning I do not believe that any one single mechanism will satisfactorily explain all fractures.

All theories of mechanism fall into one of three classes depending upon the modes of force transmission as follows:

1. The force is transmitted by means of bony segments exclusively, no ligament

being involved. To this class belong the theories of Dupuytren, Velton and Malgugne.

2. The force is concentrated upon the anterior radiocarpal ligament which tears off a fragment. Here belong the theories of Le Comte, Tillaux, Delbet, Contremoulin and Fülcher.

3. The force follows a complex course from humerus to ulna and from ulna to radius by way of the interosseous membrane. This view is defended by Lepes and Hennequin.

One of the earliest theories was that of Lenteau and Le Petit (31) who compared the radius and ulna to a bow and bow string. In a fall the elasticity of the bow is exceeded and it breaks. This was a poor explanation and was soon succeeded by others. In the first half of the nineteenth century it was generally the view that the typical fracture arose through *coup et contrecoup* or compression. The most zealous advocates of this view were Dupuytren (8), Malgugne (5) and Velton (29). Velton attempted to prove it by experiments on the cadaver.

In these experiments the forearm was articulated at the elbow, the olecranon sawed off and the detached forearm supported vertically on a plane surface with the hand at right angle in the position of hyperextension. A heavy blow with a hammer was then given upon the upper end and as a rule fracture of the radius at the typical site took place. Later, however, it was found that typical fracture did not occur nearly so frequently if the anterior radiocarpal ligament was sectioned; the other conditions of the experiment remaining the same.

Another view gradually gained ground. Bouchet (4, 1834) did not believe that the radius fractured between two opposing forces but that the lower end was torn off following strong extension of the hand and as a result of traction by the anterior radiocarpal ligament. According to Voillemier (46) transverse fractures arose through the pull of the strongly stretched capsular ligaments while diagonal fractures and impacted ones arose through direct violence. Continuing this, Le Comte (3) stated in 1860 that all typical fractures arose through *arrachement* or

tearing and dislocated altogethether the theory of *coup et contrecoup*.

Fülcher of Brooklyn is a strong exponent of this theory (31) and his article on the subject is very convincing. I quote from his description of the mechanism.

That fractures of the lower extremity or base of the radius should be of frequent occurrence or appreciate when the mechanism of its usual production is understood. A fall on the forearm of the faller broken by an outstretched arm with bare flexor tendons are the usual conditions from which it results. In the course of such an accident the flexor tendons of the hand with overextension of the anterior common ligament of the carpal joint project anteriorly. Strain is brought to bear on the projecting anterior lig of the lower end of the radius. The slipping first row of carpal bones as it moves in the cup-like cavity of the lower articular surface of the radius, furnishes the mechanism through which the force is transmitted into a crushing strain upon the ligament to which the ligament is inserted with the result that that portion of the bone is torn off.

Examine a longitudinal section through the wrist joint from the middle of the radius to the middle of the third metacarpal bone. The section passes through the semilunar and the outer portion of the os magnum. The carpal bones and the metacarpals are joined together with such firmness that but slight motion is permitted between them. In the movements of flexion and extension at the wrist they act virtually as one bone. At the lower extremity of the radius projects anteriorly a prominent lip upon which is inserted the anterior radiocarpal ligament to the extent of a section of whose fibers continues for a quarter inch or more above the articular margin. This ligament though dense and strong is sufficiently loose to permit considerable latitude of motion backward of the carpus upon the radius. The posterior radiocarpal ligament unites the bones together behind similarly.

The bones thus relate I constitute two levers! They may be represented as in the accompanying diagram by *A* and *B* held together by band *E* at *C* and *D*. When *B* is forcibly carried backward (extension of the hand) the band *D* is made tense the opposite border of the lever hanging slipped forward as far as the fulcrum *C* will permit now abuts against the lower surface of *A* which becomes a fulcrum for the further action of the lever. The mechanical arrangement is such that an immense power may be exerted. If the backward force continues to act either the band *D* must rupture or a lever be fractured. The projecting lip upon the upper leuc puts it at a disadvantage. The band continues to sustain

I have noted this theory is accomplished by the dislocation of the radius. In the middle of the lever *A* the lever is composed of the radius and the metacarpal considered as one bone. The pressure is applied to the ligament *D* at *D* and the radius is torn off.

the strain. The lever gives way. The point of fracture is necessarily just above that portion of the lever controlled by the band. The strain upon the lever is nearly transverse to its long axis. By this the direction of the line of fracture is determined. A fracture has been produced by definite forces at a definite point and in a definite direction. These are practically the conditions which unite in the production of the more common fractures of the inferior extremity of the radius.

By the powerful leverage which the extended hand and carpus obtain through the strong anterior ligament upon the lower end of the radius that portion of the bone is literally torn from it.

When the lower fragment of the radius has been torn off it becomes virtually a part of the carpus with which it moves and by which it is carried backward.

This then constitutes the mechanism of the fracture according to Pilcher who is representative of a group of adherents to this theory. He has likewise established the truth of it by experimental demonstration upon the fresh cadaver. For this purpose the forearm is firmly held and the wrist bent sharply backward until something gives way usually with a snap. Upon dissection as a rule the radius will be found to be fractured at about the typical site although occasionally the anterior radiocarpal ligament will be found to have ruptured. Clinical evidence is also presented in which this mechanism has certainly been active.

According to this conception other forces such as that of impact the perpendicular wedge like impact of the carpus against the articular cup of the base of the radius descent of the upper fragment into the lower and explosive splitting of the lower fragment account for comminution impaction and displacement. The forces come into action after the fracture has taken place.

We have still to consider the third class of theories mentioned above that in which the force follows a complex course from humerus to ulna and from ulna to radius. The theory of Hennequin (13) is representative of this group. As has been shown above the contact between ulna and humerus is much more extensive and intimate than that between radius and humerus on the other hand at the wrist conditions are reversed and the ulna scarcely enters into the formation of the articulation at all. Hennequin believes that

the force of the falling body is transmitted from humerus to ulna thence by means of the interosseous ligament to the radius attaining its maximum concentration at the lower end of the latter bone. Here it meets with the resistance offered by the hand coming in violent contact with the ground. Force and resistance are equal in opposite directions according to the well known physical law likewise a law of mechanics states that when a lever of non homogeneous construction is subjected to two opposing forces it breaks at a point intermediate to the application of the forces nearest to the place where they concentrate. The radius corresponds to a lever of non homogeneous construction and under the conditions of a fall is subjected to two opposing forces therefore it breaks at the point of their maximum intensity or at its lower end.

To me this theory is very attractive the detailed presentation of it by its author is very plausible and I am convinced that it may be invoked to explain some fractures although not all.

We have now briefly considered a representative of each of the three classes of theories of mechanism. The very fact that such a multiplicity of theories exists would seem to prove that no one would satisfactorily account for all fractures and reasonable objections have been raised to all.

For instance against the theory of tearing off of the lower fragment by the anterior carpal ligament it has been urged (Hennequin 13) that this ligament can have no action on the lower extremity of the radius except when the hand is extended so as to make a right angle with the forearm. As this degree of hyperextension is rarely realized in falls on the palm of the hand the intervention of another factor is necessary. This is undoubtedly true. But in automobile fractures this hyperextended condition is the rule and not the exception. Again by this theory it is difficult to explain the comminution of the lower fragment which is common and difficult to explain impaction and posterior deviation of the upper end of the lower fragment with anterior deviation of the upper fragment.



Loebker (24) believes that any of these mechanisms or more frequently combinations of them may be active in any given case and I am also of this opinion but I further believe that a great many of the fractures in this situation are caused by the impact of the carpal bones against the lower end of the radius with simultaneous damage to the ligamentary apparatus of the wrist joint the extent of the fracture being dependent upon the attitude of the wrist and the severity and duration of the violence as held by Walkowitsch (48)

Just a few words to make this clear Take the conditions present in a fall with the hand in hyperextension and deviated toward the ulnar side as is natural under the circumstances Under such conditions the cartilaginous surface of the os naviculare begins to press against the posterior or dorsal border of the radial articular surface The carpus deviates radially bringing pressure to bear especially upon the styloid of the radius and leading to stretching of the external lateral ligament of the wrist joint On the ulnar side conditions are reversed, the pressure coming on the volar side with simultaneous stretching of the internal lateral ligament If now the radius attempts to pronate it is hindered by the os naviculare and we have a concentration of two forces at this point

The entire force may be expended on the posterior border of the articular surface breaking it off or more commonly the two forces one due to the dorsal push of the carpus against the lower end of the radius and the other a torsion from radial to ulnar side due to the action of the pronators on the upper portion of the radius come together higher up

It should be emphasized that the pressure of the carpus on the joint end of the radius or vice versa the radius on the carpus can exert its full influence only when the internal lateral ligament which prevents ulnar deviation of the hyperextended hand is torn There are several things speaking in favor of this chief of which is the fact that the most frequent complication of fracture of the lower end of the radius is fracture of the ulnar styloid to which this ligament attaches In

other cases the ligament may be torn without fracture of the ulnar styloid This is not demonstrable by X ray but may be assumed from localized pain and tenderness ulnar deviation of the hand and prominence and palpability of the lower end of the ulna Also a thinning of the ligament without rupture may occur Some injury to the internal ligamentary apparatus is necessary for the production of this fracture in most cases and in a certain number can be assumed to be the first act in the entire fracture mechanism since only after the tearing of this ligament which prevents the deviation of the hand to the volar side can the carpal bones come completely under the posterior border of the radius and exert their full power

After fracture if the forearm continues to act the lower fragment takes a dorsal and radial displacement and tends to a more supinated position than the upper This position is maintained by interlocking of the fragments and also by muscular action on the dorsal side This latter action can be readily visualized when the close connection of the extensor tendons with the lower end of the radius is considered The action of these muscles is concentrated on the fragment as soon as fracture occurs

Much more might be said in the discussion of these various theories but to do so would unduly prolong an already sufficiently lengthy paper For the same reason I shall not attempt to take up the associated pathology which is always present in every fracture to a greater or less degree Such associated pathology consists in hemorrhage between fascial planes laceration of muscles resulting in hæmatomata serous exudates into tendon sheaths richer in fibrin if tendon is injured torn ligaments inflamed synovial membranes hæmarthrosis etc All these conditions must be considered in the treatment

#### DIAGNOSIS AND TREATMENT

The diagnosis likewise need not detain us long The characteristic silver fork deformity is well known and the X ray which should always be used in the great majority of cases makes known with certainty the condition present In this connection note

that occasionally a case of injury in the region of the lower end of the radius will present itself with localized bone or pencil tenderness considerable swelling which appears at once and subcutaneous ecchymosis after 24 to 48 hours in which case the X ray is negative. Under such circumstances the X ray should not be held conclusive but the case should be treated as a fracture.

Let us now briefly take up the treatment. The successful treatment of all fractures requires good judgment common sense constant attention to details and the election of a method which in the individual case will lead to a restoration of the form and function of the injured limb in the shortest possible time with the least danger and inconvenience to the patient. In the treatment of fractures of the lower end of the radius two things are of equal importance. The first is early complete reduction and the second is careful painstaking after treatment in which massage and passive motion play a prominent role and in which the use of splints is not abused.

Some reduction is necessary in practically every case of complete fracture of the bone across the lower end. A cursory examination of the X ray may show apparently no displacement and there may indeed be none as regards the position of the end of the two fragments. In such a case particular attention must be paid to the plane of the carpal articulating surface of the radius. If this is not in proper position the result will be a functionally imperfect wrist. Normally this surface is tilted slightly forward in the case of fracture it is tilted backward to a greater or less degree as a result of condensation of bone on impaction on the posterior aspect of the fracture. This must be corrected if the result is to be successful.

For reduction a general anæsthetic should always be employed. The wrist should then be placed in a position of extreme hyperextension. This immediately relaxes the muscles tendons and periosteum if it has remained unbroken as is sometimes the case and allows any impaction present to be broken up by manipulation. The lower fragment is then forced into position by pressure

over it. Once reduced the displacement shows little tendency to recur.

For a permanent dressing light anterior and posterior wood splints are very satisfactory. Plaster of Paris has no place in the treatment of this fracture. The anterior splint should be cut out to allow for the thenar eminence the posterior one cut out for the head of the ulna. Both should be well padded. They are applied with the hand and arm in a position half way between pronation and supination with the hand slightly adducted. They are held in place by adhesive plaster strips and a bandage put over all. The arm should now be perfectly comfortable any marked pain any throbbing any blueness coldness or numbness of the fingers is an indication that the dressing is too tight and the condition should be immediately remedied. The patient should be informed of this and instructed to report any of the above signs or symptoms at once should they appear. If possible he should be kept in the hospital for the first day or so under constant supervision. In any event if this cannot be done the dressing should invariably be inspected within 4 hours following its application.

The after treatment of the fracture now begins and it is just as important as the primary treatment. A good functional result after a fracture even with some anatomic defect is better surgery than a perfect anatomic result with ankylosis in a very short time and since forcible movements should not be employed to break up joint adhesions for from 2 to 3 months after the injury it is important to prevent adhesions from forming. The early and intelligent use of massage and passive motion is the best way to accomplish this end. These two measures properly used aid absorption of periarthritic and joint effusions prevent atrophy and weakness hasten healing and lessen joint and tendon sheath adhesions and ligament contractures.

This treatment should be begun by the third or at the latest the fourth day using the utmost gentleness. The dressing should be removed completely and very light massage and very slight passive motions instituted. For the first sitting five minutes

of this is sufficient and absolutely no pain should be caused the dressing is then replaced. This same procedure is repeated every other day at each sitting lengthening the time of massage a trifle and slightly increasing the amplitude of the passive motions always being extremely careful to avoid giving rise to any pain whatever. If the treatment can be carried out daily so much the better usually every other day will have to suffice. The interior splint may be discarded altogether by the tenth day and by the fourteenth the patient may begin gentle active movements in addition to the passive ones. A few days later or by the end of the third week the posterior splint may be taken off a firm supporting dressing of gauze and adhesive being applied about the wrist at the site of the fracture. The sling however should be retained and the patient instructed as to how to carry the arm in it in the absence of splint control of the position of the arm the latter is held in the mid position between pronation and supination and the edge of the sling comes just below the lower end of the ulna so that the hand and wrist by their weight naturally assume an adducted position. Passive and active motions and massage should still be continued as outlined.

By the end of the fourth week union should be firm enough for the patient to begin to use the wrist for light household tasks however this early activity should involve absolutely no strain on the newly formed bone at the site of fracture. The average patient should be able to return to light manual labor at the end of 6 to 8 weeks but full heavy work involving marked strain and stress on the wrist should not be attempted before the tenth or twelfth week.

In conclusion operative treatment of fractures in this situation is practically never indicated in recent cases as the treatment outlined will give just as good functional results as could be obtained by any other means. But in neglected cases and cases in which the final result is far from satisfactory surgical treatment of some sort may be indicated. During the first three weeks whatever union has taken place can usually be broken up by manipulation under an anes-

thetic and the case then treated as an open fracture. After the third or fourth week an open operation will be necessary. At this time an osteotomy in the line of fracture followed by treatment appropriate for a recent fracture will give the best results (Lathrop 21). In fractures which have existed for several months too much cannot be promised from operative interference. Deformity may be corrected although after 6 or 8 months this is sometimes very difficult and even after correction of deformity function frequently is not improved. Each case should be studied very carefully and cases for surgical interference selected only after all factors involved have been considered.

#### SUMMARY AND CONCLUSIONS

1 Fractures of the lower end of the radius are among the most frequent with which the general practitioner has to deal and as such are very frequently not given the care they deserve with a consequent increase in the proportion of unsatisfactory end results.

2 These end results can be improved if more attention is given to the details of treatment and after treatment.

3 A thorough knowledge of the anatomy of the parts and the mechanism of the usual fracture is essential to proper treatment. The anatomy is reviewed and various mechanisms described.

4 It is probable that no one mechanism will satisfactorily account for all cases. These mechanisms fall into three general classes depending upon direction and mode of transmission of the active forces.

5 Any of these or combinations of them may be active in any given case.

6 Successful treatment of these fractures consists in immediate complete reduction preferably under an anæsthetic and early passive motion and massage.

7 Operative treatment as a rule is indicated only in old badly treated or untreated cases.

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quently overlooked. Bimanual palpation with the patient in the lateral position helps materially in outlining the tumor. Attention is here called to the danger of rough palpation as hemorrhage may be produced and the possibility of squeezing tumor cells into the general circulation must also be considered.

Pain was the third most frequent symptom. In analyzing this symptom a number of interesting facts were brought to light. In the first place as previously mentioned pain in 18 cases preceded other manifestations by weeks, months or years. The location of the pain is variable and often impossible to associate with a renal condition. The pain caused by the passage of blood clots is colicky in nature and immediately attracts attention to the kidney. The pain not associated with bleeding may be a dull lumbar ache or a sharp neuralgia following the course of distribution of the ilio inguinal and genito-crural nerves. A few patients complained of so-called severe lumbago others of intractable sciatica or mild abdominal cramps. Attacks of lumbago or sciatica in patients of advanced years which do not yield to the usual methods of treatment should make one suspicious of the possibility of a renal neoplasm. Severe neuralgic lumbar pains have been described in cases in which the growth has broken through its capsule.

TABLE SHOWING APPEARANCE OF CARDINAL SYMPTOMS (PAIN AND HÆMATURIA) PRIOR TO OPERATION

Pain	Case		C
1 d y	1	1 1/2 years	
2 d ys	3	2 yrs	
5 d ys		3 years	2
6 days			
7 d ys	1	Hæmaturia	
2 wks		3 d ys	
3 wks	3	week	
5 week		2 wks	
6 weeks	1	2 months	
3 mths	3	3 mths	
3 month	4	5 mths	
3 m mths		year	
4 months	1	5 years	
5 month	3	years	
6 months	2	3 years	
7 mo ths	3	5 years	1
8 months	1	1 six or seven times	
9 month	1	set of pain could not be	
10 m mths		give	
1 year	6		

Loss of weight was noted in at least 33 per cent of cases. In 5 patients this was the only symptom observed for some time previous to the appearance of any of the classical signs.

Cachexia generally a late manifestation was present fifteen times. Most of these cases had advanced lesions with metastases. Many patients however with well advanced lesions and renal vein involvement looked remarkably well. A form of cachexia has been described appearing early in the course of the disease before the onset of hæmaturia and tumor. In such instances the differential diagnosis between renal tumor, tuberculosis and other chronic disorders may be most difficult especially when fever is present.

#### METASTASES

Twelve patients or 20 per cent already had metastases when first observed. In two instances the metastases dominated the clinical picture, no suspicion being entertained of a renal lesion. In the first case the patient's pulmonary symptoms were diagnosed as tuberculosis later on as a primary lung neoplasm. Months after a profuse hæmaturia immediately cleared up the situation. In the other case a small tumor over the tibia was removed and found to be a metastatic hypernephroma, thus first directing attention to a kidney tumor. A number of cases have been reported in the literature in which the metastases have appeared long before the advent of renal symptoms. The points of predilection for secondary deposits are the lungs, long bones, liver and brain. Metastases into the small intestine have been described as a rare occurrence. Carcinoma of the kidney also metastasizes along the course of the ureter and in to the bladder. Involvement of the retroperitoneal glands in the region of the kidney was found four times in 60 cases, three times in carcinoma, one in hypernephroma. Fever ranging between 100 and 102 degrees was observed eight times without the presence of pus in the urine. Israel (5) first called attention to this symptom and found it present in 57 per cent of his cases. He considered it due to toxic products generated by the tumor and independent of any infection in the growth or

urinary tract. As can be readily seen its presence in cases without tumor formation and hæmaturia may tend to confuse the diagnosis.

The symptoms above described may be classified as primary and are the ones most frequently present during the course of this disease. Secondary manifestations due mainly to the effects of pressure of large tumors on various organs and blood vessels are not infrequent. Varicocele especially when it appears on the left side has been described as a diagnostic symptom of renal tumor. It differs from idiopathic varicocele in that it does not disappear on lying down and is due either to pressure or thrombus formation in the spermatic vein. We have not observed this phenomenon in any of our cases. Oedema of the lower half of the abdomen and legs, pigmentation of the skin as in Addison's disease and increased blood pressure due to abnormal adrenalin secretion may also be classified as secondary symptoms.

#### DIFFERENTIAL DIAGNOSIS

ROSSING has classified the symptomatology of renal neoplasm in relation to diagnosis under three headings:

1. Cases with palpable tumor and hæmaturia
2. Cases with palpable tumor without hæmaturia
3. Cases with hæmaturia without a palpable growth

1. *Palpable tumor and hæmaturia*. This group is of course the easiest to diagnose as the hæmaturia immediately focuses attention to the kidney. Only a few conditions such as stone and tuberculosis need be considered in the differential diagnosis.

*Palpable tumor without hæmaturia*. It will be necessary first of all to determine whether the tumor in question is renal in origin or not. This may require various examinations such as colon inflation, roentgenography of the gastrointestinal tract and pyelography. Renal tuberculosis, hydronephrosis, pyonephrosis and calculus are readily differentiated. Occasionally a tumor may be associated with either of the latter conditions as happened in two of our cases. In neither

instance was the presence of a growth suspected. Echinococcus cyst of the kidney may present the same palpatory finding, i.e. a hard irregular surface so often noted in tumors. Tumors of the adrenal may simulate renal growths and differentiation be impossible without exploration. Polycystic disease especially when only one kidney is palpable may offer considerable difficulty in the differential diagnosis.

3. *Cases with hæmaturia without tumor*. This group presents the greatest difficulties in diagnosis. Even after the most painstaking studies embracing all our known procedures it will occasionally be impossible to differentiate the bleeding of tumor from the so called 'essential hæmaturia'. We have explored at least a half dozen cases diagnosed however as belonging to the essential hæmaturia group in which doubt existed in our minds as to the accuracy of our observations. Under such circumstances exploration of the kidney is always justified.

#### CLINICAL AND UROLOGICAL DIAGNOSTIC PROCEDURES

Abdominal inspection in early cases generally yields no information. Large tumors are readily noted as is also pigmentation of the skin, varicocele and oedema. Palpation gives more valuable data concerning the consistency, surface contour and mobility of tumor. Bimanual examination with the patient in the lateral position is a valuable procedure. Probably more than 80 per cent of renal growths can be palpated by this method. The importance of a careful urinalysis cannot be too strongly emphasized, especially if there is only microscopic blood. Tumor cells were found in two of our cases in catheterized kidney specimens and a correct diagnosis of malignancy made. Ordinary roentgenography by outlining the size and shape of the kidney will often prove of value. In 15 cases distinct enlargement and irregularity of the kidney outline was observed. In a few cases we have been justified in excluding malignancy by roentgenograms showing a perfectly normal kidney shadow. With perirenal oxygen insufflation we have had no experience although the German literature mentions this as a

valuable aid in outlining renal shadow. Inflation of the colon gives information as to the retroperitoneal position of the growth. Small tumors as a rule lying posterior to the colon. Large ones displacing the colon mesially. Gastrointestinal roentgenography may also help in localizing the growth.

*Functional tests* *phthalain* and *indigo carmine* and *bleedchenistry* estimations where of value in determining the functional capacity prior to operation are not in themselves of diagnostic importance because similar findings may be obtained in other conditions. In our series all but a few cases showed a diminution or absence of indigo carmine output on the diseased side. It is conceivable that with a small growth the tests may be not at all conclusive. Observation cystoscopy yields valuable information especially where a bloody efflux is noted. Both measures should be observed before the ureters are catheterized as traumatic bleeding may be produced by the catheters. In a few cases large blood clots were seen protruding from the orifice of the affected side. It was not unusual to note changes around the ureteral orifice of the diseased kidney such as edema of the meatus and submucous hemorrhages. When examined in the hematuria free interval forcible manipulation of the ureteral catheter in the renal pelvis with the idea of traumatizing the growth and producing an active hemorrhage has occasionally aided in determining the source of the bleeding. The wax bougie is a valuable diagnostic aid in differentiating the bleeding of tumor from a calculus which fails to show in the roentgenogram.

*Pyelography* The knowledge obtained by means of pyelography is of incalculable value in the diagnosis of renal neoplasm in fact it may be said without contradiction that it is probably the most important diagnostic method at our disposal. Kidney tumors sooner or later in the process of their development produce malformations of the renal pelvis or calyces which become manifest in the pyelogram by rather characteristic distortions. The type of tumor cannot always be determined by the pyelogram but this is not of importance. The fact is that this method gives us information which may ren-

der it possible to diagnose early malignancy perhaps before the advent of classical symptoms.

At the time of our previous communication pyelography was not as frequently practiced as it is now when every case of renal hematoma is subjected to this examination. Pyelography should also be indicated in all cases of renal pain in the absence of definite lesions such as stone, tuberculosis, etc. Pyelograms of kidney tumors are often so varied and bizarre in appearance that it would require too much time at present to describe the manifold changes encountered. Braasch in his excellent monograph has ably depicted them. Suffice it to say that distortion, elongation and retraction of the calyces, obliteration of one or more calyces and filling defects of the pelvis resulting in narrowing and partial obliteration are the most characteristic. Large tumors may cause a displacement of the pelvis with marked ureteropelvic deformities. The interpretation of the pyelogram is not always a simple matter. It may be impossible to differentiate between a large retroperitoneal mass (mytoma, or sarcoma or glioma) and a kidney tumor either by pyelography or cystoscopy. The kidney as a result of compression by the mass may have an inhibition of function thus simulating a renal condition. Iressure may distort the organ as to produce pyelographic changes similar to those seen in renal neoplasms. We have had a few cases in which it was not possible to determine from the cystoscopic findings and the pyelograms whether or not the tumor was a renal neoplasm. In both instances the tumors proved to be retroperitoneal growth. The pyelographic changes produced by polycystic kidneys may resemble those of renal tumor. When in doubt the other kidney should be injected for polycystic disease is generally bilateral. Filling defects due to a stone which fails to show in the roentgenogram and the presence of blood clots in the pelvis may occasionally cause some confusion. In 23 cases in which pyelography was done there were positive findings indicative of renal neoplasm twenty-one times two pyelograms were considered doubtful. This will serve to illustrate the value of pyelography.

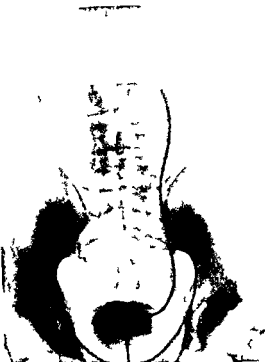


Fig 1. Cancer of kidney filling defect in pelvis and irregularity of calyces



Fig 2. Hypernephroma showing dilatation of calyces with pelvic deformity

#### DIFFERENTIAL DIAGNOSIS OF THREE TYPES OF KIDNEY TUMORS: HYPERNEPHROMA, CARCINOMA AND PAPILLARY CARCINOMA OF RENAL PELVIS

The differentiation of the three main types of kidney tumor is often impossible although a careful study of the symptoms, clinical findings, cystoscopic and roentgenographic examinations will occasionally make this feasible. Suggestive of hypernephromata are its frequency (60 to 80 per cent of kidney tumors), slow progress in early stages, late cachexia, single metastases, pigmentation of skin, history of lumbar pain, often extending over the course of a few years and long interval between attacks of hæmaturia.

*Carcinoma* runs a more rapid course; tumors do not generally attain such a large size as hypernephroma; cachexia appears early, and calculi are more often present than in cases of hypernephroma. Metastases are multiple.

*Papillary carcinoma of renal pelvis*. During the past few years, reports of this condition

have become more frequent. There were five cases in our series, four carcinomata, one sarcoma. Tumors of the pelvis are characterized by a hæmaturia generally very profuse and with short intervening periods. Bladder metastases in the region of the ureteral orifice are seen in this type of growth rather frequently. A unilateral renal hæmaturia associated with a bladder tumor points strongly to a primary papillary tumor of the pelvis. Intermittent hæmatonephrosis due to obstruction of the ureter by clots is rather characteristic. Following the passage of the obstructing clot, large quantities of bloody urine which may contain tumor fragments are passed. There is usually more marked pelvic dilatation as evidenced by the pyelogram in tumors of the renal pelvis. Calculi are found associated not infrequently in our series, three times.

#### TUMORS OF KIDNEY IN CHILDREN

Malignant tumors of the kidney in children are rather uncommon. According to statistics







Fig 5 Hypernephroma (filling filling of the pelvis and blurring the calyx)

be the first manifestations noted. Examination then reveals a large intra abdominal tumor. Pain is not a prominent symptom and if present is not severe. As contrasted with tumors in adults haematuria is of infrequent occurrence either as an initial symptom or at any stage of the disease. In our cases haematuria was present four and absent six times in one the bleeding was only microscopic. The diagnosis is not difficult. The same urological examinations practised in adults as has been shown by different authors can usually be carried out in children. Metastases are not common local recurrences are. Death is generally caused by cachexia and local recurrence. The operative mortality is high reports varying from 36 per cent to over 50 per cent. The transperitoneal route is usually employed on account of the large size of the tumors. Two of our cases were considered inoperable one was explored and found inoperable seven were nephrectomized. The prognosis as to cure is very bad recurrences generally taking place within a year after



Fig 6 Hypernephroma (filling filling of the pelvis and blurring the calyx)

operation. The ultimate mortality has been placed between 80 per cent and 90 per cent. In our series of eight operations there was one postoperative death a mortality of 12.5 per cent. Four patients died within 6 months one within a year. Two cases could not be traced. One patient (hypernephroma) is alive and well 6 years after X-ray and radium from current reports in the literature seem to offer but little encouragement.

#### THE RELATION OF EARLY SYMPTOMS AND PROGNOSIS TO PATHOLOGY AS FOUND AT OPERATION

The question naturally arises whether patients presenting themselves in the early stages of the disease as determined by the appearance of the initial symptoms (pain and haematuria) have correspondingly incipient pathological processes. If so is the prognosis better than in cases with a longer duration of such symptoms. A careful comparative study frequently proves that this is not true as illustrated in the following group arrangement.

Group 1. Initial symptoms (pain and haematuria) appearing from 2 days to 2 months before operation.



Fig 7. Carcinoma kidney

## 14 Cases

- 5 showed growth in renal vein
- 1 showed growth in renal vein and vena cava
- 1 showed retroperitoneal gland involvement
- 8 of tumors were large in size
- 2 proved to be inoperable as determined by exploratory operation

5 of the 6 patients died within the year  
1 patient had metastases in lung

Group II Initial symptoms (pain and hematuria) from 6 months to 1 year

## 12 Cases

- 5 showed growth renal vein
- 2 showed retroperitoneal gland involvement
- 1 larger and more fixed tumor in this group
- 3 proved to be inoperable as determined by exploratory operation

2 patients died within the year

Group III Initial symptoms from 1 to 3 year

## 15 Cases

All large growths



Fig 8. Carcinoma kidney. Metastatic growths in lung

Four inoperable tumors determined by exploratory operation

More fixed growths

Five deaths within year

Two showed renal vein involvement

In the majority of patients surviving operation 2 to 4 years the initial symptoms appeared from 5 months to 1 year previously. A number of patients who succumbed within a year had initial symptoms of short duration 6 days to 4 months

## OPERATIVE CONTRA INDICATIONS

Having established a definite diagnosis the question of operability is next to be considered. There are certain types of cases which one knows from previous experience are not suitable for operative interference. Large fixed tumors which have no mobility are as a rule inoperable. In attempting to free the kidney there is great danger of a fatal hemorrhage or of injuring the neighboring hollow viscera. In 2 cases of this type in which nephrectomy was done the patients died from profuse hemorrhage. In all of the exploratory operations very large fixed tumors were found. At the time we were of the opinion that the patient was justified in receiving the benefit of an exploration but found nephrectomy impossible. In this type of case Federoff has ad-



Fig 9 Papillary carcinoma of kidney. Tumor in pelvis pressing the middle of the kidney.



Fig 1 Carcinoma of kidney. Tumor in pelvis.

used a subcapsular nephrectomy, excising the fatty and proper capsule after the kidney has been extirpated.

*Metastases in relation to operative indication.* Radical surgery of course is not to be considered if multiple growths are found disseminated. Since single metastases readily react surgically (as has not infrequently been reported during the course of this disease) in the absence of cachexia these should not contraindicate radical operation. The kidney should first be extirpated followed as soon as possible by excision of the secondary growth. There are reports by Albrecht, Israel, Brenner, Colmer, Scudder, and others in which patients have lived for years following the removal of a secondary deposit. Occasionally the metastases have been removed first through a mistaken diagnosis and the kidney subsequently extirpated. It is important that the lungs and bones should be X-rayed before operation for possible secondary deposits.

#### TREATMENT

There is only one recognized form of treatment and that is nephrectomy. Radium and deep X-ray are to be used only as adjuvant. Deep X-ray therapy occasionally of value in inoperable cases for controlling hematuria.

Lumbar nephrectomy is the usual procedure. In our adult series there were forty-two lumbar nephrectomies and five transperitoneal nephrectomies; the latter procedure being reserved for very large growths. Besides the usual oblique incision a transverse lumbar incision has been recommended dividing if necessary one rectus muscle. This incision gives a very good exposure. If a question arises as to the operability of a case



Fig 2 Carcinoma of kidney. Tumor in pelvis.



Fig. 12. Hypernephroma of the kidney (limit of pelvis).

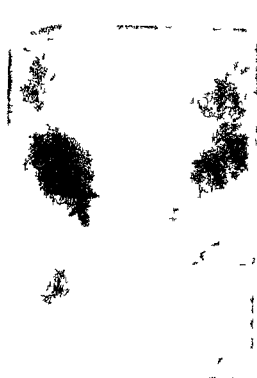


Fig. 13. Pleuro-lymphoretroperitoneal sarcoma.

it is advisable to open the peritoneum and examine the liver for metastases. The renal vein should be ligated as early in the operation as possible to prevent neoplastic tumor cells from being squeezed into the general circulation. It is important to excise entirely the fatty capsule of the kidney.

**Operative mortality.** The published statistics vary from 11 per cent to 33 per cent. Transperitoneal nephrectomy has a higher mortality because of the fact that the peritoneum is opened and that we are dealing with more advanced lesions for which this type of operation is reserved. Most of the deaths are caused by cardiac failure, pneumonia, peritonitis and uræmia. Cardiac failure has been mentioned as the cause of death in an unusually high percentage of cases (66.7 per cent Israel<sup>5</sup>). Israel attributes this to a toxic myocarditis caused by the breaking down of hypernephroma tissue and notes that it is more frequently observed in cases in which the vena

cava has been invaded by the growth. In the majority of instances of cardiac death there were no previous evidences of cardiac disease. In our series of 47 nephrectomies in adults there were 3 deaths and a mortality of 6 per cent.

**Renal vein involvement.** Twenty cases showed extension of the growth into the renal vein and few into the vena cava. This complication although occurring in carcinomatous growths is more characteristic of hypernephromata. Reports from various clinics as to its frequency vary from 10 to 22 per cent. Involvement of the renal vein even though rather extensive does not necessarily indicate a fatal prognosis. One would imagine that once the tumor had invaded the vein early metastases must be inevitable. Numerous instances have been cited in which patients have survived for years following the removal of hypernephromatous plugs from the renal vein and vena cava. Albrecht<sup>(2)</sup> reports one patient alive 4 years and one 12 years; the



Fig. 4. Uric acid calculus in renal vein (showing filling of lumen by thrombus).

Mayo (6) 5 and 14 years after this procedure. At least 10 patients in our series with renal vein involvement have survived operation from 1 to 5 years. The vein was found thrombosed five times in the group of 14 patients in whom the initial symptoms had manifested themselves only a short time previous to operation. In going over the case histories it was surprising to find such a high percentage in what were thought to be early cases.

**Procedure in renal vein involvement.** The renal vein is opened and the thrombus which occasionally extends into the cava is carefully and gently removed. It may be necessary to make an opening into the cava in order to extract all of the growth. In one of our cases a small incision requiring a suture was made in the cava to aid in extracting the thrombus. When the growth is firmly attached to the wall of the cava excision of part of the vein has been advocated followed by lateral suture. E. Rehn (7) has lately reported such an instance and gives detail as to the various operative procedures to be employed in excising these growths from the wall of the vena cava.



Fig. 5. Large thrombus in renal vein (showing filling of lumen by thrombus).

#### PROGNOSIS AND REMOTE RESULTS

The prognosis in general is bad death occurring from recurrence, cachexia or metastases often as late as 10 years after operation. Many such late recurrences have been reported. The majority of deaths occur within 2 years following operation. A three year period by no means insures a favorable prognosis as a number of our patients survive this period of time only to develop metastases a year or so later. The percentage of cures varies considerably as the following statistics show.

Israel in 34 patients reports 18 deaths from recurrence or metastases within 2 years. Garceau in 43 patients 39 deaths from recurrence or metastases within 3 years. Cunningham in 31 patients reports that only 9 had passed three year period. Kuester had 11 per cent cures at end of 4 years. Braasch 7 per cent cures at end of 3 years and 10 per cent cures at end of 4 years. Pleschner reports 17 per cent cures at the end of 3 years and 48 per cent cures at end of 5 years. Berg

reports 5 cases all dead within 7 years  
Laschen collected 68 cases only 1 per cent  
were free from recurrence after 3 year

From these and other statistics it can be  
seen that the percentage of three year cures  
averages 20 and 30 per cent five year cures  
probably less than 15 per cent thus evidencing  
the extreme malignancy of renal neoplasm  
In a recent report from the Mayo Clinic (8)  
embracing a large series of kidney tumors  
(243 cases) an attempt was made to correlate  
the postoperative data with the pathological  
data so as to determine the mortality rate  
accompanying the different types of tumor  
Time does not permit a discussion of this study  
which seems to be a very comprehensive one

#### ADULT STATISTICS

Patients operated	32
Nephrectomies	
Lumbar	42
Transperitoneal	5
Flank operation	5
Distal flank nephrectomy	3
Dehiscence of wound	1

#### DATA OBTAINABLE IN 42 CASES POSTOPERATIVE

Death	14
First year	2
Second year	2
Third year	2
Fourth year	2
Alive	
61 months postoperative	4
3 years	4
3 years (remission)	
2 years (local recurrence)	
3 years (with local recurrence)	
4 years	4
5 years	
7 years	
Approximate three year cure	1
Approximate five year cure	75
Approximate permanent cure	9

#### DEEP X RAY AND RADIUM TREATMENT

I have seen no statistics on the influence of the  
X rays and radium on renal neoplasm and our  
own are not extensive enough for us to formula-  
late any definite conclusions. We have had no  
experience with the X rays in the pre-operative  
preparation of patients. Of the patients sur-  
viving operation 8 had been treated with X  
ray or radium. Three of these had radium im-  
planted deep into the wound near the pedicle  
soon after operation the other five were

treated after operation with deep X ray.  
The patients so treated did not seem to do  
better and the percentage of lasting results is  
no higher than in the first series of 40 patients  
who were not treated with X ray. In fact of  
six patients who have survived operation over  
4 years but one was so treated. One patient  
who had received more than 12 treatments  
developed a local wound recurrence within a  
few weeks after the cessation of treatment.

#### Total Number of Cases Treated with

X ray or Radium	14
Cases	
61 months	3
1 year	1
1 year	0
2 years	1
2½ years	2
4 years	1
5 years	0
7 years	

#### CONCLUSIONS

In conclusion I wish to call attention to the  
extreme malignancy of kidney tumors the  
difficulty of early diagnosis the disproportion  
between early symptomatology and pathologi-  
cal findings and the importance of pyelo-  
graphic data. Whereas early diagnosis based  
on classical symptoms does not necessarily  
indicate a favorable prognosis extension into  
the vein does not render the prognosis hopeless.  
The ultimate mortality ranges between 65 and  
75 per cent and the only way to effect a re-  
duction of this high rate at present would be  
to use the cystoscope and make pyelograms  
not alone in every case of hematuria but in  
every case in which the patient complains of  
lumbar pain for which no definite cause can be  
found and to examine more carefully patients  
complaining of intractable sciatica and lum-  
bago.

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NON-CARCINOMATOUS TUMORS OF THE STOMACH<sup>1</sup>

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NON-CARCINOMATOUS tumors of the stomach although much less common than cancers of this organ are nevertheless of considerable surgical importance because they can be recognized in the vast majority of instances only by exploratory operation and because removal of the tumor may not only result in permanent relief of symptoms but may also prevent malignant degeneration and the occurrence of complications which might result fatally. In spite of this importance from a diagnostic as well as a curative standpoint comparatively little is written on the subject in the textbooks so that one may gain the impression that non-carcinomatous tumors of the stomach instead of being of considerable clinical importance are rather more of a pathological curiosity. In order to correct this possible misconception we have made a careful survey of the literature on this subject and we wish to describe our experiences with a series of cases of non-carcinomatous tumors of the stomach consisting of 1 case of myofibroma, 2 of polyps, 1 of adenoma, 1 of hypertrophic pyloric stenosis in an adult as well as the inflammatory tumors such as syphilis of the stomach and the inflammatory enlargement of the pancreas associated with peptic ulcer.

## MYOFIBROMA OF THE STOMACH

Myoma or myofibroma of the stomach is not so uncommon a condition as one may suppose by reading the ordinary textbooks on the pathology of this organ. Nasetti (16) was able to collect 140 cases up to 1919 of which number 38 had undergone malignant degeneration. E. L. Hunt (8) in 1923 was able to add 9 more such cases from the literature making a total of 149 reported cases up to that year. The importance of this condition does not depend entirely upon the diagnosis of the tumor *per se* or its possible re-

moval with the probability of permanent cure but upon the fact that a large proportion undergo malignant degeneration or may cause complications which may result fatally. As previously mentioned Nasetti found that more than 7 per cent of myomata or myofibromata of the stomach had undergone malignant degeneration and there was some doubt at first in our own case if sarcomatous degeneration had not already set in. The complications which may produce a very acute clinical picture or may even result in death are chiefly hemorrhage and pyloric or duodenal occlusion by the tumor mass. Severe hemorrhage without other symptoms is reported by F. Erkes (7), E. Weber (24) and W. Kleiber (9). Intermittent vomiting and hematemesis were reported by J. H. Outland and L. Clendening (19). An acute clinical picture with severe pain and collapse was reported by E. Neuber (18) and J. E. G. Calverley (5) while a more prolonged course was reported by J. B. Camp (6) and E. L. Hunt (8). The case we report is of interest because operation resulted in a cure and because it illustrates the difficulty of diagnosis of myoma of the stomach chiefly because it occurs usually between the ages of 50 and 70 and is therefore often mistaken for carcinoma until operation reveals the true nature of the condition.

J. E., a white male age 57 years, a hardwood finisher by trade, entered the medical service of the County Hospital on August 3, 1924 with a complaint of having been ill for 8 months prior to admission. He had severe epigastric pain which was constantly present but became worse 2 or 3 hours after meals three times a day. There were also moderate constipation and a loss of 10 pounds in weight in the last month of his illness. Nausea, vomiting or blood in the stools were never present. There was nothing of importance in his past or family history which would have any bearing on his present complaint.





days after operation completely relieved of symptoms. The patient 4 months later stated that he had gained many pounds in weight and thought himself cured.

The pathological report is as follows: The resected specimen consisted of the distal half of the stomach in its entire circumference. A pear-shaped tumor mass 7.5 by 4 by 5 centimeters was attached by its side to the lesser curvature and superior portion of the posterior surface of the stomach. The apical end of the mass pointed toward the pyloric orifice and the entire mass projected outward from the stomach rather than into its lumen. The mass was everywhere covered by peritoneum, was of firm consistency and grayish white in color except at its base where the tissue became brownish red. There were no adhesions or attachments to other organs and the mass was distinctly circumscribed and sharply defined from the remaining uninvolved portion of the stomach wall.

We opened the resected portion of the stomach through the tumor mass and along a line parallel to the lesser curvature and found a fasciculated, meaty mass which looked not unlike a brownish marble. The tumor grew outward from the stomach wall and was completely covered on the inside of the stomach by intact mucosa and on the outside by unbroken serosa. The tumor mass evidently arose from the muscular layer of the stomach wall leaving the mucosa, submucosa and peritoneum uninvolved. The wider half of the tumor was dark reddish brown in color, even more firm than the lighter colored, narrower portion and contained several large sized hemorrhagic cysts, evidently the result of degeneration of this portion of the tumor.

Microscopic section from the darker portion showed muscle tissue which had undergone advanced hyaline change. Blood pigment might be seen deposited in various places and many of the blood vessels showed evidences of hyaline degeneration. A section taken from the lighter colored portion including the mucosa showed that the mucous membrane including the muscularis mucosae and the submucosa were of normal thickness and were not affected by ulcerative inflammation or other pathological change. The tumor arose from the muscularis and extended outward. The mass consisted chiefly of typical muscle cells with normal nuclei and protoplasm and with little interstitial tissue. Bundles of interlacing bands of connective tissue were seen to form some of the tumor in this region but the cells of the connective tissue were normal in appearance and showed only an occasional mitotic nucleus. The cancer was not only in the penetration of the layers other than the muscularis by tumor tissue and no histological evidence of malignancy.

From the appearance of the tumor on gross and microscopic examination we believe the specimen to be a nongastric myofibroma arising from the muscular layer of the stomach, all showing advanced hyaline degeneration. It may have large areas and marked hemorrhagic cystic formation in the wide end of the mass.



Fig. 1. Microscopic section of myofibroma of the stomach. The tumor mass is seen on the right side of the specimen. The tumor is composed of muscle tissue which has degenerated into a brownish red mass. The tumor is surrounded by normal gastric tissue. The tumor is labeled 'a' and the normal tissue is labeled 'b' and 'c'.

#### GASTRIC POLYPS

Polyps of the stomach have seldom been recognized clinically unless a part of the tumor tissue has been recovered from the stools, vomitus or lavage water. The advent of the X-ray in diagnosis of diseases of the stomach has made the recognition of this condition much easier so that there are now reports of cases of polyps of the stomach recognized clinically and corroborated by subsequent operation. Such cases are recorded by J. P. McCullough (12), J. S. Myer (15), and Stoner (23) and show that a more careful consideration of the clinical manifestations and X-ray findings will probably result in a more frequent recognition of polyps of the stomach. As in myoma of the stomach the importance of recognizing the presence of gastric polyps lies in the prevention of malignant degeneration which occurs in about 60 per cent of instances and in the avoidance of possible complications the chief of which is continuous and profuse hemorrhage which may result fatally. Another curious and very alarming complication is intermittent pyloric or duodenal obstruction as reported by J. W. Shuman and D. Cruikshank (22) and R. Matas (11). The importance of these possible



Fig. 3. Microscopic section through light and dark portions of myofibroma showing muscular fibers and fibrous tissue.



Fig. 4. Microscopic section through dark portion of myofibroma of the stomach showing muscular fibers and fibrous tissue.

complications and the comparative paucity in the number of reports of gastric polyps there being but 122 reported cases in the literature according to Rosenbach and Disque (20) in 1933 prompts us to report two additional cases in one of which there was also a chronic peptic ulcer and a small carcinomatous tumor in addition to the polyps.

CASE 1. J. R., a male age 50 years a laborer entered the medical service of the Cook County Hospital on August 12, 1919 with a complaint of abdominal pain nausea vomiting belching and loss of weight. Digestive disturbances had been present for about 15 years but were considerably worse for the last year. The abdominal pain as sharp and cutting was located in the region of the umbilicus and did not radiate. While a gnawing pain was constantly present it was aggravated in from one half to 1 hour after meals and was relieved by vomiting. There was a loss of about 30 pounds in weight in the past year of his illness and the patient felt that he was getting much weaker. Belching occurred before and after meals. His bowels were regular. There was nothing of significance in the family or past history except a copious hæmatemesis 25 years ago. He was an excessive user of tobacco and whiskey.

Examination revealed a fairly well nourished white male with a pulse rate of 68 respirations 20 and normal temperature. There was nothing abnormal in the head neck or chest and examination of the abdomen revealed some tenderness over the umbilicus but no mass could be palpated. The liver was palpable at the costal margin. The extremities

revealed nothing abnormal the reflexes were normal. The Wassermann of the blood was negative. The urine was normal. The stomach contents removed 1 hour after an Ewald test meal showed absence of free hydrochloric acid and a total acidity of 7 on three different occasions. Röntgen examination showed a definite and constant filling defect at the greater curvature of the stomach in the pyloric region. There was no definite degree of obstruction but the appearance was that of a malignancy.

A diagnosis of carcinoma of the stomach was made perhaps following a gastric ulcer and the patient was transferred to the surgical service. Operation was performed on August 28, 1919. An incision was made through the left rectus muscle and the stomach exposed. No tumor could be palpated from the outside but on opening the stomach an extensive papillomatous growth could be seen to involve the entire pyloric portion of the stomach. The distal half of the stomach was resected and the stump sutured to the jejunum according to the method of Délya. The patient rapidly improved and was discharged on October 19, 1919 almost completely free from symptoms.

The pathological description is as follows. The specimen consisted of the pyloric portion of the stomach. The serosa was smooth everywhere and without evidence of inflammation or adhesions. On opening the specimen the mucosa was seen to be studded with numerous soft cauliflower-like projections of variable size resembling large and small polyps some of which were attached by a narrow pedicle and some by broad bases. The mucosa over these projections was wrinkled but intact and showed no evidences of ulceration. A section cut through one of the larger polypoid growths also



Fig 5 Multiple polyp of stomach having the stalk composed of a thick stalk of submucosa covered by mucosa. The muscularis is seen at the base of the polyp. A polyp with a narrow pedicle is seen at the right.

traversing the underlying wall of the stomach showed that the peritoneum and muscular layers were uninvolved. At the site of one of the polyps the submucosa was seen to send up a long thin finger-like process to the lumen of the stomach. This projection of submucosa was covered on all sides by normal muscularis mucosae and mucosa so that the two layers covered the projection of submucosa like a glove on a finger. Microscopic examination showed the polyp to consist of a stalk of submucosa with its loose connective tissue and blood vessel and the entire structure to be covered by a layer of normal mucous membrane. The layers were everywhere intact; the cells typically mature and there was no evidence of malignant degeneration either from the epithelial or connective tissue elements. The anatomical diagnosis in this case was benign polyp of the pyloric portion of the stomach.

CASE 2 D S a male age 53 years and a laborer was admitted to the medical service of the Cook County Hospital on October 24, 1924, with a history of having been ill for years with abdominal pain, vomiting, anorexia, loss of weight and constipation. His symptoms occurred in periodic attacks lasting 2 weeks to 1 month, one having occurred 2 years ago, another 5 months ago and the last attack 2 weeks ago. The abdominal pains were severe cramplike, extended across the upper abdomen especially under the left costal arch and caused him to double up. They occurred about 3 hours after meals and were relieved by vomiting and alkalies. Vomiting occurred after solid or liquid food and the vomitus consisted of food and at times of brown fluid. He had lost 15 pounds in the last 2 weeks, and the constipation was quite severe. The patient did not speak English very well and no further history could be obtained.

Physical examination revealed a fairly well nourished middle-aged male with normal pulse, respiration and temperature. Nothing abnormal was found in the chest except moderate emphysema.



Fig 6 Microscopic section through a polyp of the stomach showing the stalk of submucosa covered by mucosa. The muscularis is seen at the base of the polyp. A polyp with a narrow pedicle is seen at the right.

Slight tenderness was present along the entire left side of the abdomen and was especially marked in the upper portion. The reflexes and blood pressure were normal. The urine showed nothing abnormal. A Wassermann of the blood was negative. Occult blood was found several times in the stools. The stomach contents after an Ewald test meal on several occasions showed an average free hydrochloric acid of 15 and total acidity of 45. The X-ray showed nothing abnormal in the chest except a slightly widened aorta. The duodenal bulb filled out well but a considerable residue was left in the stomach after 6 hours. A filling defect was seen at the lesser curvature near the pylorus. A diagnosis of pyloric obstruction probably due to carcinoma was made. Operation was performed on December 15, 1924. A midline incision was made in upper abdomen. The pyloric half of stomach was resected and the operation completed according to the method of Pólya.

The resected specimen consisted of the pyloric part of the stomach including about 1 centimeter of duodenum. The serosa was everywhere smooth and transparent except at a point along the lesser curvature where it was thickened by plaques of white fibrous tissue. There was a nodule 1 centimeter in diameter slightly raised above the surface of the mucosa located on the greater curvature about 3 centimeters from the pylorus and was cartilaginous in consistency. The nodule was yellowish white in color and on cut section showed a firm granular surface which was separated from the surrounding tissue by an irregular line of demarcation. At a distance of 3.5 centimeters from this nodule and on the lesser curvature a typical chronic peptic

ulcer of the mucosa could be found oval in outline 2 by 1 centimeter with the long axis parallel to the lesser curvature. Numerous small polypoid growths of variable size were found near the ulcer the nearest one being 5 centimeters away. None of these polyps was ulcerated. No signs of malignancy were seen at the ulcer. A mucoscopic section through the nodule previously described showed that the mucosa appeared normal at both ends but that the central portion consisted of typical glandular carcinoma. The carcinoma infiltrated the submucosa and the muscularis mucosae but did not involve the muscular coat itself. Microscopic examination of the polyps revealed the typical structure described in Case 1 but there were several areas which closely resembled malignant hyperplasia.

#### ADENOMA PLASMA

Adenoma en nappe or plaque like adenoma of the stomach, one of the rarest forms of benign tumor of this organ. It consists of a diffuse adenomatous thickening usually at the pyloric portion of the stomach and involves only the mucous membrane. Menetrier (13) being the credit of best describing this condition and his masterly description in 1858 still stands as the most complete work on the subject. There are probably not more than three or four reports of this condition in the literature and as it is almost impossible to differentiate it clinically from carcinoma of the stomach we mention a case reported elsewhere which was operated upon several years ago with apparently a complete cure (1).

CASE 5. The patient a married woman aged 38, not reflecting any history of chronic diarrhea marked loss of weight, anorexia, vomiting of small quantities of food and mucus and vague dyspeptic symptoms all of which were present for 5 years. Examination showed a very emaciated middle aged female who was in poor general condition. Stomach contents after an Ewald test meal showed a complete absence of free hydrochloric acid and a trace of combined acid. Lactic acid was present. Numerous test for occult blood in the stools were made but the results were consistently negative. A ray examination showed a large filling defect of the pyloric portion of the stomach involving chiefly the greater curvature. The same phenomena were present on several examinations and a tentative diagnosis of extensive carcinoma of the stomach was made. The long duration of the illness and the apparent slow course of the disease together with the presence of diarrhea led us to suspect that our diagnosis could have been incorrect and operation was advised. Exploratory laparotomy revealed no tumor on inspection of the anterior and posterior

surfaces of the stomach. The stomach was then opened but inspection of the inner surface revealed no carcinoma. The wall of the stomach was very thick the mucosa was quite thickened and congested and the inner layer of the stomach was thrown into large folds so that it resembled prominent cerebral convolutions. This condition was especially marked in the region of the pylorus especially at the greater curvature. The pyloric half of the stomach was resected by the Blandin antral gastroenterostomy. Histological examination of the resected portion showed the typical histological picture of adenoma en nappe. The patient was seen 5 months later and stated that all symptoms had disappeared and that she had gained much weight. Another communication from her 1 year later stated that she was in perfect health.

#### HYPERTROPHIC PYLORIC STENOSIS IN AN ADULT

Hypertrophic hypertrophy and spasm of the pylorus in adults is a rare condition there being but a few other cases reported in the literature (C. Brunner 4 J. Schultze 21 J. Mickulicz 14 Telford 10 and C. Nauwenk 17). The case we wish to report is of importance chiefly because it is impossible to differentiate it from carcinoma and because the patient died although operation could probably have saved his life. A detailed report of this case may be found elsewhere ( ).

CASE 1. The patient a white male aged 46, as a limited to the Cook County Hospital on December 11, 1922 with a previously diagnosed carcinoma of the stomach. He had been ill for 8 months with abdominal pain, marked loss of weight and strength and had been vomiting for the last month. The pain was in the epigastrium, came on almost immediately after eating and was relieved at first by the vomiting. The vomitus consisted of mucus, food and dark brown material resembling coffee grounds. He had lost about 55 pounds in the last 8 months. Examination revealed a very emaciated person and examination of the abdomen showed that a large hard nodule was palpated in the left upper quadrant. Excision of a four plus Wassermann of the blood and an absence of free hydrochloric acid in the stomach contents notwithstanding the importance was found. A ray examination revealed a large obstruction of the antrum of the pyloric region of the stomach. He died 5 days after admission. Autopsy showed a stomach which was markedly dilated. The pyloric opening was narrow the mucosa was red a little mottled resembling gastric carcinoma. A large saddle back shillock ulceration on the lesser curvature at the pylorus and its largest diameters were 7 by 4.5 centimeters. The hollow depth of the ulcer made it appear more like an crater. Examination of the

pyloric portion of the stomach revealed a very marked thickening of the wall in this region and microscopic examination showed that the thickening was due chiefly to a hypertrophy of the muscle layer in this region. There was no evidence of malignancy or chronic inflammation. No changes were found such as were described by us in a previous communication which would lead us to suspect a luetic process (W. A. Brams and Karl A. Meyer 3). A diagnosis was made of idiopathic pyloric hypertrophy with resulting stenosis and secondary erosion of the mucous membrane.

#### INFLAMMATORY CONDITIONS OF STOMACH AND VICINITY PRODUCING TUMOR FORMATION RESEMBLING CARCINOMA OF STOMACH

In a previous communication (3) we reported 2 cases of anatomically proved syphilis of the stomach which produced a clinical picture very closely resembling carcinoma. We mention this condition in our series because of the rarity of anatomically proved gastric syphilis, there being but 14 other cases reported in the literature and because the recognition of well developed cases should not offer insurmountable difficulties in diagnosis. As was pointed out in our previous report the diagnosis rested chiefly on a history of chronic digestive disturbances, anacidity of the stomach contents, a filling defect on X-ray examination, marked emaciation and a history or evidence of previous luetic infection or response to specific treatment after ordinary measures failed. An absolute diagnosis can be made only on histological examination of the involved portion of the stomach, a detailed description of which may be found in our previous communication. The chief point of importance lies in the fact that the thickened pyloric portion of the stomach may produce a palpable mass which together with a marked emaciation and absence of free hydrochloric acid may produce a clinical picture difficult to differentiate from carcinoma until a detailed histological study had been made.

Finally we wish to call attention to the not uncommon involvement of the pancreas in association with chronic peptic ulcer. As a result of inflammatory and proliferative changes in the pancreas this organ may become enlarged either in part or entirely and may produce a mass in the epigastrium which can easily be mistaken for carcinoma. Failure

to recognize the cause of this tumor formation during operation can mislead the surgeon so that the causative peptic ulcer of the stomach is overlooked or the necessary operative procedure not undertaken because inoperable malignancy is suspected.

#### RÉSUMÉ

1 A series of non carcinomatous tumors of the stomach is reported consisting of 1 myofibroma, 1 polyp, 1 adenoma *en nappe*, 1 hypertrophic pyloric stenosis in an adult and mention is made of certain inflammatory conditions, namely syphilis of the stomach and inflammatory pancreatitis associated with chronic peptic ulcer.

2 The importance in recognizing these conditions consists of the fact that operation except in syphilis of the stomach is the only procedure which can cure the patient. Even syphilis of the stomach may require surgical aid if the symptoms of obstruction are severe or if marked connective tissue scar stenosis has developed.

3 The non malignant tumors of the stomach, especially the myomata and polyps may undergo malignant degeneration in a large proportion of the cases and early radical removal is the only logical method to prevent this complication.

4 Polyps and myomata may cause severe or fatal hemorrhage or occlusion of the pylorus or duodenum with alarming symptoms.

5 Recognition of these tumors and prompt surgical treatment may not only cure the conditions but may also prevent the occurrence of the serious complications sometimes caused by benign growths of the stomach.

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Fig. 1. Photomicrograph of section taken distally showing wing-like squamous epithelium lining clusters of sebaceous glands and nodule cartilage.

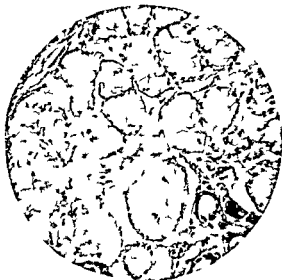


Fig. 2. Photomicrograph of section taken near proximal end showing high type salivary mucous glands.

4 The finding microscopically of salivary gland tissue. This means that we were dealing with either an aberrant salivary gland with its duct opening on the skin surface or a teratoid structure which included salivary tissue.

5 The groove in the mandible. This indicated that the duct must have been present during early fetal life.

6 The presence of cartilage in an unusual location. This would tend to substantiate the teratoid nature of the whole structure.

#### DISCUSSION

Were we dealing here with a teratoid structure containing salivary tissue which having an outlet continued to function or was it an aberrant salivary gland? Its location in the region where salivary gland tissue is normally found would point to the latter, as would also the fact that food stimulated its secretion. But more significant is the presence of cartilage not normally found in this region which we think puts the structure in the teratoid group.

Teratoids do produce functioning gland tissue depending it is believed upon the time in the development of the embryo at which the anlage of the structure was separated. In a very early undifferentiated stage it is very doubtful as to whether functioning tissue

would be produced. But later when cells become better differentiated and possess a potentiality for the production of a certain gland as salivary gland in this case there would hardly be any question as to their power of producing a functioning gland. We know there are frequently found aberrant salivary glands with ducts opening into the floor of the mouth and these function. Also we know that teratoids contain functioning glands. A dermoid contains functioning skin glands the secretion being sebaceous. We find also teratomata with thyroid tissue containing colloid.

The possibility that this might be a thyroglossal duct seems to us to be definitely disproved. The history is not the usual one of a thyroglossal duct. The location of the duct above the hyoid bone and entirely unconnected with it would seem to be another very definite point against this possibility. The idea that we were dealing with salivary tissue opening into a thyroglossal duct could not be substantiated. Thyroglossal ducts are usually lined with a ciliated columnar epithelium instead of a squamous epithelium. The evidence rather indicates that we are dealing with a teratoid structure containing salivary tissue. This tissue continued to function because of an anomalous duct formation.



## SYPHILIS IN RELATION TO PREGNANCY

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A. M. D. C. (1884), O. C. (1885), C. (1886)

THE present age, as it affects the practice of medicine, may truly be said to be an age of prevention in so far as its primary aim is to foretell, anticipate and prevent the occurrence and spread of disease in any form. Hence it is inevitable on account of its great prevalence, its ravaging ramifications and above all its most protean character that so much attention should be focused upon syphilis. Of all lesions none is more widely met with and none demands more thorough study and investigation than the venereal disease, especially when it occurs in conjunction with pregnancy. That this should be so is evidenced by the ever prevalent incidence of hereditary syphilis with its resultant economic burden upon the state and its biological waste of human life.

At the cut of therefore too much emphasis cannot be placed upon the necessity for an actively intensive and concerted co-operation between the obstetrician, the syphilologist, the pediatrician and the social hygienist in providing thorough study and care for each pregnant patient who presents herself to us during a most important epoch in her life for her own welfare and that of her unborn child.

In any preventive campaign the fundamental fact to be ascertained is who is diseased and how many are diseased. It follows therefore that one of the safest methods of ascertaining the incidence of syphilis in pregnancy is by the performance of a routine Wassermann test upon all pregnant women from every walk of life. The necessity of this measure is at once apparent to anyone who has attempted to obtain a history of lues from a pregnant woman. Jean for instance states that in his series 8 per cent of mother denied all knowledge of the infection. Beck in his studies reports that he was able to obtain an aid to diagnosis only by history and physical examination in 15.72 per cent of cases. While I am ready to admit that a carefully obtained history bearing particularly upon previous abortions, miscarriages or prem-

ature labors or the birth of macerated fetuses as well as a history of any symptoms suggestive of lues is of paramount importance nevertheless in the light of our own experience together with that reported by others we feel fully convinced that the routine Wassermann test constitutes at the present time a most valuable diagnostic procedure.

On account of the greater difficulty in diagnosing lues in women as compared to men in respect to the detection and recognition of the initial lesions it follows that the disease in women is more often overlooked with its resultant ill effects upon the mother as well as her unborn child. The reason for this is apparent when one remembers that in a considerable number of cases the primary lesions in women are about the cervix or in the upper part of the vagina in which region they are for obvious reasons unrecognized or are often confused with other pathological entities. In our series of cases which we are willing to limit constitutes too small a number from which to deduce absolute conclusions the value of the performance of a routine Wassermann upon every obstetrical patient has been very markedly impressed upon us.

In only 4 patients in the series of over 400 could we obtain a definite history suggestive clinically of syphilis. One of these was an illegitimately pregnant primipara who admitted previous but inadequate treatment and who showed the existence of a tertiary syphiloderma. The other was a multipara who stated that her husband had received a few intravenous administrations of salvarsan. The other two patients who had a strongly positive serologic reaction gave absolutely no history suggestive of a lueal infection and showed no clinical evidence of any of the usual signs of syphilis.

The incidence of syphilis in pregnancy according to the figures reported from various clinics and based upon the findings from a routine Wassermann test varies from about 3 to 4 per cent. Among others Hinton of

Boston found a positive reaction in 4.18 per cent in a series of 1047 pregnant women while Williams of Baltimore reports 48 per cent positive reactions in white women in a collective series of 4347 cases. Our own series gave a positive reaction of 90 per cent in 413 cases.

We now come to a consideration of the significance of a positive Wassermann reaction occurring in a pregnant woman and here we must digress for a few moments to discuss the validity of the dictum known as Colles' law. In 1837 Abraham Colles, the Dublin surgeon, announced the possibility of a mother giving birth to a living or dead syphilitic child without herself showing any evidence of the disease and that she would remain immune to infection from her own child while others might be infected by it.

This hypothesis of course presupposed infection of the ovum by means of the permatozoon and the subsequent development of immunity by the mother. In other words it supports the paternal theory of infection. For many years Colles' law was universally accepted and among other Journer was an ardent believer in its validity. However it remained for Mitzenauer in 1903 to challenge and in fact deny the applicability of the formula. Following the discovery of the procreta pallidum in 1903 and of the Wassermann reaction in 1907 the correctness of Colles' law has been subjected to intensive investigation with the result that most writers absolutely deny its validity upon both clinical and other grounds. In other words the maternal theory of infection in which the mother is infected primarily and the fetus secondarily is favored by most investigators.

The skepticalism in regard to the paternal theory of infection is in great measure justified when we recall that the relatively large size of the procreta pallidum compared with that of the permatozoon would make it highly improbable for the parasite to be carried into the ovum by the male element. Another objection which has been advanced but which has not as yet been proved is that the procreta cannot survive in general albumin alone but need differentiated cell which are not present in the ovum.



Fig. 1. Maternal infection. Combined section of the placenta and fetus. The maternal infection is evident in the placenta.

Hence the possibility of the paternal theory of infection is questioned by some and denied by many. The plausibility of these objections is further enhanced by the findings of a positive Wassermann reaction in pregnant and puerperal women who are supposed to substantiate the law of Colles. For some unexplained reason it is argued that the disease exists in a latent form without giving rise to the usual signs and symptoms. Consequently the reason why the mother does not become infected by the child is that she is already suffering from the disease.

Notwithstanding the objections raised so eminent an authority as Williams cites two extremely interesting cases which together with his extensive experience and exhaustive investigations upon the subject under discussion force him to the conclusion that the possibility of Colles' law has not yet been proved or disproved and the dictum therefore must be regarded as still *sub judice*. Similarly the law of Prochazka which states that syphilitic parent may give birth to a non-syphilitic child or that the child develops an immunity *in utero* has also been disproved by long con-

tinued observations upon such infants and by the Wassermann reaction

With this discussion of the laws of Colles and Profeta we may now ask ourselves two questions. What significance should be attached to the occurrence of a positive Wassermann reaction in pregnancy? Does it inevitably mean that the mother is suffering from syphilis and that she will transmit the disease to her child? While the Baltimore school is not prepared to answer the first question conclusively and while among others Menten has shown that a positive reaction before parturition will often become negative shortly after delivery I am inclined to agree with Browne of Edinburgh who as a result of a recent intensive investigation states that the presence of a strongly positive Wassermann reaction may be said to constitute very decisive evidence of the presence of syphilis in the pregnant woman. Although in total disagreement with Moore Browne also concludes from his study that there is no evidence whatever that the reaction is modified by pregnancy for he states that he has never known of a case in which a Wassermann positive before pregnancy became negative during pregnancy apart from treatment. Nor has he ever known of a case in which a Wassermann negative during pregnancy became positive after delivery. In reference to the second question however the present state of our knowledge permits us to state definitely that the finding of a positive Wassermann on the mother during pregnancy does not necessarily mean that the child will develop syphilis for it is conservative to assume in the light of recent studies that less than one-half of the women with positive reactions will give birth to syphilitic children.

As to the significance of the Wassermann reaction on the cord blood at the time of birth the consensus of opinion seems to be that a positive reaction does not necessarily mean that it will remain so and conversely that a negative Wassermann at birth does not necessarily preclude the possibility of it becoming positive later.

Fordyce and Rosen support Williams Kiluffe and other investigators in their conclusion that the results of cord Wassermanns

are not to be unreservedly relied upon when taken alone and should not be made the sole basis for a diagnosis of syphilis in the newborn. Hence the study first made by Fildes in 1915 is confirmed by others who in addition offer the opinion that the information obtained by the Wassermann made from the fetal blood at birth is not commensurate with the time and money expended in such studies. Compared to this however the routine microscopic study of the placenta for the detection of so called Frankel's disease especially in suspected cases is of greater significance and affords more conclusive evidence as to the presence or absence of syphilis than does serological investigation.

#### PLACENTAL SYPHILIS

This leads us to a short consideration of placental syphilis or the pathology of the syphilitic placenta first accurately described by Frankel in 1873. The histopathological changes which syphilis produces in the placenta are so characteristic as to be almost pathognomonic of the disease. Grossly the placenta is increased in size and weight for the duration of pregnancy so that instead of weighing  $\frac{1}{4}$  to  $\frac{1}{2}$  the weight of the child the ratio in syphilis may be increased to  $\frac{1}{4}$  or more. The organ is pale fatty oedematous of a yellowish greasy appearance and more friable than usual. Extensive infarction is a common finding. If a fresh specimen be teased in water or normal saline solution one can observe marked changes in the chorionic villi which show a decrease in the usual dichotomous arrangement they are thickened and of irregular size and the ends of many villi exhibit a distinct clubbing and a marked decrease in their vascularity.

These characteristic histopathological changes are of course due to an obliterative endarteritis and endophlebitis in turn the result of the syphilitic infection. In section one can observe an increased density in the stromal cells which have lost their stellate appearance and are more closely packed together and resemble connective tissue cells. The caliber of the vessels is greatly decreased and not infrequently there may be an entire disappearance of them so that only very small



Fig. Combined injection of the ascaric acid into the placenta of a patient at term whose blood Wassermann reaction was strongly positive, who first began the early months of pregnancy. The patient was treated with arsenic and given birth to a living apparently healthy child. Notwithstanding the absence of any abnormal changes in the placental tissue, the absence of syphilis in the fetal blood and the absence of any changes in the fetal blood.

vessels may be seen in the large villi. Hence infarction which is so commonly seen by diminishing the blood supply often accounts for the poor development and frequent death of the fetus with its premature expulsion. The demonstration of spirochætae in the placenta although quite difficult at times may be accomplished by proper technique after the method of Levaditi.

#### INFLUENCE OF SYPHILIS UPON PREGNANCY

Quite often the patient exhibits an aggravation of the ordinary subjective discomforts of pregnancy and complains of intense headaches, persistent neuralgias, insomnia, alopecia, secondary anemia, loss of weight and at times a persistent fever of a moderately severe degree. On account of the vascularity

of the tissues during pregnancy the primary lesions are sometimes more persistent than in non-pregnant women and the lesions of the genital mucous membranes appear to be greatly stimulated. Condylomata increase in size and the lymph nodes may become markedly swollen.

#### INFLUENCE OF SYPHILIS UPON LABOR

While labor may be quite normal in many cases nevertheless abnormal deviations are not infrequently encountered. On account of the frequent prematurity or maceration of the fetus abnormal presentations are comparatively common. According to Gellhorn weak contractions due to primary uterine inertia is not an infrequent complication. An unfavorable condition which one may have to con-

tend with is that due to an abnormal resistance of the cervical tissues which on account of *oedema* and marked induration as well as an increased proliferation of the connective tissue and a sclerosis in the surrounding vessels may give a wooden consistency to the cervix so that the impression conveyed to the examining finger is that of a hard ring pessary. Premature rupture of the membranes may add to further delay in cervical dilatation. In those cases presenting signs of maternal or fetal exhaustion operative interference may become necessary and may include either incisions of the cervix or delivery by forceps.

When tertiary lesions and ulcerations are present obstacles may present themselves at the outlet with resultant deep perineal lacerations. Gellhorn states that a perineal tear occasioned by the presence of syphilitic lesions should not be repaired but should be allowed to heal by granulation aided by intensive antiluetic treatment following which secondary perineorrhaphy may be attempted. Rarer complications such as postpartum hemorrhage, spontaneous rupture of the uterus, premature separation of the placenta, etc. have been recorded by various authors.

#### INFLUENCE OF SYPHILIS UPON THE PUERPERIUM

The two most important complications which one may have to deal with are infection on account of the lowered resistance of the syphilitic individual and subinvolution due to imperfect contraction of the diseased uterine musculature. Hence when in the absence of the usual causes of subinvolution the condition does not yield to the usual lines of treatment syphilis should be borne in mind as a possible etiological factor. Pyrexia during the puerperium is not necessarily caused by syphilis.

#### INFLUENCE OF PREGNANCY ON SYPHILIS

In 1920 Brown and Pearce carried out an experimental study on the reaction of pregnant and lactating females to inoculation with *treponema pallidum* in which they showed that a pregnant rabbit inoculated with the spirocheta at the time of conception failed to react to infection in a manner similar to non-

pregnant controls. In his clinical studies on the course of syphilitic infection in pregnant women Moore has shown that in the human as in the animal definite alterations in the course of lesions are caused by pregnancy.

The most important of these consists either in a complete suppression of the usual early lesions of the disease provided infection and impregnation approximately coincide or if infection occurs during the course of or in late pregnancy the patient may develop the usual manifestation of syphilis which are however much milder than if she is infected independently of pregnancy. The protection against the early lesions of syphilis afforded by pregnancy according to Moore may persist over many years and possibly for a lifetime.

In his series of 200 cases, those women who developed late syphilis were especially prone to involvement of the viscera and cardiovascular system while tertiary lesions of skin or bones and particularly neurosyphilis either clinical or asymptomatic were rare. He also points out that almost half of the women who are clinically neurosyphilitic have not been pregnant since infection. The exact nature of the mechanism by which pregnancy causes the alterations in the course of a syphilitic infection is at present unknown but several possibilities have been advanced.

It has been suggested that on account of the chemical alterations in the blood and tissues of pregnant women of which the outstanding feature is a marked increase of cholesterol in the former pregnancy afford a protection against as well as an alteration in the course of a syphilitic infection. Routh on the other hand has advanced a theory which has not yet been proved but which presupposes that chorionic ferments are cast off into the maternal circulation and that this factor suppresses the syphilitic lesions. Finally as a last resort a betrothal as it were between syphilis and the poor endocrine system which bears so much insult the chief cause for all ailments has been suggested with the result that the glands have been accused of causing these alterations in the pregnant syphilitic. Moore states that his studies convince him that the majority of women who acquire syphilis simultaneously with the

occurrence of pregnancy are singularly free from the graver remote complications of the disease

#### INFLUENCE OF SYPHILIS ON THE INCIDENCE OF INTERRUPTIONS IN PREGNANCY AND ON THE OCCURRENCE OF FETAL ABNORMALITIES

According to the usual statements found in many textbooks on obstetrics a history of repeated abortions miscarriages and still births is to be regarded as almost an axiom that syphilis is present and responsible for these interruptions of pregnancy. Recent studies however have been carried out which throw a great deal of doubt on such suppositions and thus a survey of the more recent literature excites a certain amount of skepticism as to whether syphilis is really such an important factor in the causation of abortion and stillbirth as was formerly supposed.

In this regard therefore the studies of Adair supported by those of Cruickshank are of great interest in that they tend to throw a new light upon the subject under consideration. Adair in an examination of 1093 women found that while the incidence of abortion is approximately 1 in every 3 pregnancies syphilis is not an important factor in its production in the first 3 months of pregnancy and that it has little influence on the incidence of miscarriage during the second trimester since the incidence for both syphilitic and non syphilitic groups is approximately the same viz about 30 per cent. However the most striking fact brought out by Adair's study was that while lues is not responsible for a large proportion of the interruptions of pregnancy in the first 6 months it is of pre dominating importance as the commonest single cause of premature births and still births in the last trimester.

This is in close agreement with the results of Cruickshank's investigations on maternal syphilis as a cause of the death of the fetus and of the newborn child. Williams in his studies has shown that syphilis is responsible for 34.44 per cent of the total number of fetal deaths in a series of 302 cases and that this is almost equal to the combined mortality from dystocia toxæmia and prematurity. In our own series of cases it will be noted

that there was a history of abortion in only out of the 12 mothers with strongly positive Wassermann reactions thus agreeing even if only in a small way with the findings of other investigators.

It follows therefore that if lues is recognized early in pregnancy and is treated intensively along appropriate lines from the standpoint of the child almost ideal results will be obtained. More will be said about this in speaking of congenital syphilis.

Up to the present time no evidence has been adduced to show that syphilis is a cause of fetal monstrosities and deformities although it is perhaps a little more frequent in children of luetic parents than in those of non syphilitic parentage. My personal experience on this phase of the subject has up to the present failed to convince me that lues is to be regarded as a specific cause for congenital malformations for in a considerable number of cases showing an anencephalic monster hydrocephalus or craniorthachischia I took a Wassermann on the mother and in every case the test proved negative. Losee reports a similar experience while Holt in 56 consecutive cases of congenital abnormalities failed to get a single positive Wassermann.

#### IMPORTANCE AND INFLUENCE OF TREATMENT OF MOTHER

The importance of instituting early treatment in pregnancy for the benefit of the mother and to insure the birth of a healthy non syphilitic child cannot be overestimated. While Fordyce and Rosen warn us that little can be expected if we delay until the last weeks of pregnancy I agree entirely with Welz and Van Nest Beck and others that full treatment should be attempted even at the end of pregnancy in the hope of securing a controlled case in a living child which can be further cared for after birth. I venture this statement in so far as pregnant women usually tolerate the treatment devoid in my experience of any deleterious effects provided of course no associated pathology of the kidneys is present.

The specific qualities of the treatment and the development of antibodies may as has

been frequently pointed out proceed through the placenta or through the milk. Creadick reminds us that Ehrlich offered this explanation as applying to those cases in which the infant improved while being nursed by the mother who was at the same time receiving intravenous medication.

This is further substantiated by the results of a recent experimental study by Underhill and Amatruda on the transmission of arsenic in the form of *neo ar phnamine* from mother to fetus. These investigators have shown that arsenic can be detected in small traces in the fetal tissues after the mother has received an intravenous administration of the drug. They state however that while the amount of arsenic recovered from the fetal tissues does not increase in proportion to the number of serial injections given the amount of arsenic which is stored in the maternal liver and placenta does increase with the number of injections. The explanation which they offer which appears reasonable in the light of their experimental investigations and from common clinical observations for the efficiency of antenatal treatment of syphilis especially on the newborn is that the drug acts in greater concentration and more directly on the spirochæta in the placenta.

That much can be expected from antiluetic treatment of the mother is shown by the highly satisfactory results obtained by Williams. In his series when no treatment was instituted 48.5 per cent of the children manifested signs of syphilis as contrasted with 39.2 per cent and 6.7 per cent when the treatment was inefficient or efficient respectively. In our series of cases out of the 12 children born of mothers with positive reactions only one gave a positive Wassermann shortly after birth and one a suspicious positive reaction while all 12 children were born alive and showed no evidence clinically of any of the usual stigmata of congenital syphilis. This therefore leads us to a short consideration as to what constitutes efficient treatment of the mother.

As soon as a diagnosis of syphilis is made the mother should receive at least 6 doses of salvarsan or its derivatives beginning with 0.4 grams and gradually ascending to 0.6

grams at weekly intervals together with 1 grain of mercury salicylate once a week for 12 to 15 injections. If the mercurial injections are painful they should be discontinued and mercury by mouth or mixed treatment should be prescribed. It is needless to remind you that careful and constant attention must be paid to the kidneys and other organs for the possible development of toxic symptoms.

If after these 6 intravenous and 12 intramuscular injections the Wassermann test remains positive a repetition of the treatment is necessary until the serological reaction is negative and remains so for at least 1 year after treatment has been discontinued. If such a plan is adhered to almost ideal results especially from the standpoint of the child will follow. Furthermore surprising results may sometimes ensue with what would ordinarily be regarded as altogether inefficient treatment in men or in non pregnant women. Hence as Williams points out there must be something about pregnancy which tends to decrease the virulence of the syphilitic infection and predisposes to a spontaneous cure. This is as was pointed out in a previous section of the paper in close agreement with the experimental work of Brown and Pearce.

Before leaving the question of maternal syphilis it may not be amiss to say a few words on the question of marriage of a patient who has had a syphilitic infection. In this respect the extensive experience of Fordyce and Losen is valuable and is worthy of being followed. These clinicians believe that a person who has had active antisyphilitic treatment who is free from all clinical evidence who has a negative spinal fluid and whose blood has been negative for 2 years may be permitted to marry.

#### FETAL SYPHILIS

It has already been pointed out that syphilis is responsible for about 30 per cent of all still births occurring in the last trimester of pregnancy. A study by Royster has shown that antenatal syphilis is not only responsible for a large percentage of stillbirths and deaths of newborn infants but also exerts a far reaching

influence in childhood adolescence and even in early adult life. Out of a total of 1000 cases treated in a free clinic 7.04 per cent of white children had inherited syphilis. Jeans studied a group of 389 infants at 2 or more months of age and by a careful physical examination and a Wassermann test found a total incidence of syphilis in 5.63 per cent of cases the percentage of whites being 2.4 per cent and that of black infants 9.3 per cent. He also emphasizes the fact that in every instance in which the placenta was noted as showing syphilitic changes the infant was later found to be suffering from syphilis. This again emphasizes the importance of a routine microscopic study of the placenta especially in suspicious cases. Other writers give the incidence of hereditary syphilis in several large American cities as varying from 2 to 6 per cent.

Although it is usually stated that 80 per cent of macerated fetuses are luetic the fact that spirochetæ are not found in the viscera of these fetuses does not necessarily exclude syphilis as the cause for failure to demonstrate the organism is usually due to faulty technique. Similarly on account of the taking of the blood of a macerated fetus a Wassermann cannot be performed in these cases.

One of the most characteristic lesions of congenital syphilis occurring in the early weeks of life is osteochondritis syphilitica first described in 1870 by Wegner who distinguished three stages of the lesion. This may be observed at the junction of the epiphysis and diaphysis of nearly all the long bones but especially the lower ends of the femora and the upper extremities of the humeri and ribs. Instead of a straight narrow whitish line of calcification at the junction of the epiphysis and diaphysis (Guerin's line) as is normally seen there is a widely irregular and thickened yellowish line which extends into the neighboring cartilaginous layer. The calcification zone is broad and more friable while the cartilaginous zone may be either enlarged or diminished. The epiphysis as a whole may become thickened and enlarged. Clinically the condition is known as pseudo-paralysis on account of the listless and mo-

tionless attitude assumed by the infant the chief symptom being a loss of function of one or more of the extremities.

Physical examination of the newborn syphilitic may disclose an apparently healthy infant showing no signs of lues during the first 6 weeks of life. On the other hand the child may be underdeveloped for the duration of pregnancy and on account of a marked lack of subcutaneous fat it may appear as the typical old man small and wizened puny weakly and sickly. The skin is usually coarse dry flabby wrinkled and of a brownish or muddy yellow color. The skin on the flexor surfaces particularly of the elbows knees and groins is very apt to crack and expose the corium which is of a reddish purple color if the child is macerated.

The limbs and face may be œdematous. On the palms of the hands and soles of the feet macules and bullæ are very frequently seen. Fissures of the lips and anus are common observations while mucous patches in the mouth and nose as well as around the anus and vulva and mucosal hæmorrhages especially of the nose are not infrequently seen.

The most common changes involving the viscera are enlargements of the liver and spleen in both of which there is a marked increase in fibrous connective tissue and a small round cell infiltration. The abdomen may be enlarged either as a result of visceral enlargement or due to the existence of ascites. The lungs are heavier than normal and show histological changes similar to those found in the liver.

If the child shows no signs of the disease at birth it usually discloses them in about 80 per cent of cases if untreated within 8 weeks when the so called late congenital syphilis manifests itself by snuffles pemphigus cutaneous eruptions paronychia restlessness sleeplessness generalized lymphadenopathy etc. In respect to congenital syphilis our diagnostic facilities have been greatly enhanced within the past 2 years by Shipley and his coworkers who in studying the skeletons of 300 white fetuses from the sixth month of pregnancy to term by means of the X-ray demonstrated typical luetic lesions of a pronounced nature in 25 per cent of cases and



well marked or suspicious lesions in 46 per cent

They have demonstrated these syphilitic lesions in all the bones but they state that there is apparently no interference with skeletal growth. Briefly, these syphilitic changes are confined to the epiphyseodiaphyseal regions and in the fetal type of reaction the periosteal lesions are secondary in importance to the endochondral defect. There is an intensification of the shadow cast by the bone at the epiphyseal line which becomes broader and more homogeneous and seems to form a cap on the ends of the trabeculae of the spongiosa which change is significant of an abnormally heavy calcification of the provisional calcified zone as compared to the very narrow zone in normal cases. The epiphyseal border of the shadow cast by the bone has a notched saw toothed or serrated appearance. The trabeculae of the syphilitic bone appear to be finer than in the normal bone.

In some cases it is worth remembering that the only clue to the diagnosis may be a progressive and unaccountable loss of weight often as much as many ounces in a day which marasmus condition ceases as if by magic with the institution of antisymphilitic treatment which we shall now briefly describe.

On account of their pre-eminence in the field of syphilology I can do no better than describe the treatment recently adopted by Fordyce and Rosen. Discarding the old fashioned method of inunction they now give from 6 to 8 intramuscular weekly injections of neutral neo-arsphenamine to the course and make the initial dose 0.1 grams for infants from 2 to 12 weeks old and gradually increase it to 0.3 grams for children 3 years old. In addition they give twelve intramuscular injections of mercuric chloride at intervals of a week in doses ranging from  $\frac{1}{16}$  of a grain for infants from 2 weeks to 6 months to  $\frac{1}{4}$  of a grain for those more than 3 years old. They follow each course of which they advise 2 full ones with a rest period of from 4 to 6 weeks regardless of a negative reaction and in some cases administer a third course of mercury.

They report eminently satisfactory results with no untoward effects from this plan of treatment. In cases in which the infant is

very much underweight with a poor musculature mercury alone is given at weekly or bi-weekly intervals until there is an improvement in the general condition following which neo-arsphenamine may be administered.

A question which frequently presents itself to us is what should be done with infants with negative Wassermann reaction born of parents with a positive Wassermann. As Fordyce and Rosen state at times it is very difficult to give a decisive answer to this question.

As these authorities point out one often sees the statement made that children of luetic parents should be treated irrespective of whether symptoms are present or not and regardless of the negative Wassermann reaction of the parents. The conservative opinion offered by Fordyce and Rosen that this is an unnecessary hardship seems to be fully warranted and one therefore is inclined to agree with them that it is preferable to keep such children under surveillance for several years after we have satisfied ourselves in the absence of clinical manifestations that the blood and spinal fluid are negative.

The child of a syphilitic mother or father should never be nursed by a non syphilitic woman for although it may how no signs of the disease there is always the possibility of it being infected and thus it will infect a healthy wet nurse. Neither should a syphilitic woman or the mother of an infected child act as a wet nurse for her milk contains spirocheta and will infect a healthy child.

From our discussion it will be seen that we as physicians have a most important duty to fulfill to humanity. As guardians of the health of our fellow beings and as a profession which must at all times be responsible for the alleviation of human suffering and of the diseases to which mankind is heir it behooves us to cooperate in a concerted manner so that we may combat the third great plague of modern civilization and thus relieve the state of a tremendous economic burden resulting from its ravages and curtail to a minimum an unnecessary wastage of human life.

#### SUMMARY AND CONCLUSIONS

1. Syphilis occurred in 2.90 per cent in our series of 413 pregnant women which percent

age is in agreement with the incidence of 3 to 4 per cent reported by other investigators

2 The performance of a routine Wassermann test in pregnancy constitutes a most valuable diagnostic procedure

3 Colles law has neither been conclusively proved nor disproved and must therefore be regarded as still *sub judice* although the maternal theory of infection is favored by most investigators and appears to be the more likely method by which the fetus is infected

4 The occurrence of a positive Wassermann reaction in pregnancy constitutes very decisive evidence of the existence of syphilis in the mother

5 The finding of a positive Wassermann on the mother during pregnancy does not necessarily mean that the child will develop syphilis

6 The results of a Wassermann reaction on the cord blood are not to be unreservedly relied upon when taken alone and should not be made the sole basis for a diagnosis of syphilis in the newborn

7 Routine microscopic study of the placenta for evidences of Frankel's disease affords more conclusive evidence as to the presence or absence of syphilis than does serological investigation

8 Syphilis may influence pregnancy labor and the puerperium in many ways with great discomfort to the mother and with deleterious effects upon the child

9 Through some unexplained mechanism pregnancy may cause definite alterations in the usual course of a syphilitic infection

10 Syphilis is not an important factor in the production of abortions in the first trimester of pregnancy and it has little influence on the incidence of miscarriages during the second trimester

11 Syphilis is of predominating importance as the commonest single cause of premature births and stillbirths in the last trimester of pregnancy

12 Syphilis cannot be regarded as a specific cause for congenital malformations or monstrosities

13 As soon as a diagnosis of maternal syphilis is made the patient should be in-

tensively treated along appropriate lines irrespective of the duration of pregnancy

14 Every newborn infant should receive a thorough physical examination very shortly after birth for the possible detection of any of the stigmata of congenital syphilis

15 Every infant showing signs of congenital lues should receive antiluetic treatment and should be kept under surveillance for a long period of time

16 Extreme caution should be exercised in choosing a wet nurse for an apparently non-syphilitic infant and similarly no syphilitic child should be nursed by a non-syphilitic woman on account of the very great possibility of infecting each other

17 All departments of medicine should cooperate in an effort to combat the incidence of syphilis in pregnancy with its resultant economic burden upon the state and its great waste of human life

TABLE I—INCIDENCE OF SYPHILIS IN FOUR HUNDRED THIRTEEN PREGNANT WOMEN

C s	Ag	Par	Prev	P gn	B by	R m k
	5	II	Abor to C	t 3/4 mo this k own	Al	W b by m p
	3	I			Al	W baby m ga ve
3	2	III	Lo t erm. t ry	fir t h by Operat t f l d	Al	W b by m egati
	7	III	P t m with dre	son preg nc f l g chl	Al	W baby m g ti
5	6	II	First pr g th b	cy full term h id	Al	W b by m taken
6		IV	P vi dr	p gn es f l h living chl	Al	W b by m p t pos k h
7	36	VI	P to erm with dre	pr gn g f l h msc rr ges	Al	W b by m g t t H b d q ly
8		III	P evio dr	preen es f l h m with g h l	Al	W baby m not t k
9		I			Al	M h y howed er y yph t d W se m g
		I			Al	W b by m eg
		III			Al	M ber tr ted
		II	Abor with Ca se	ers s m th p gn ncy k wn	Al	W baby m t k

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## RUPTURE OF THE SPLEEN WITH REPORT OF AN UNUSUAL CASE

BY THELON S JACKSON M.D. CLEVELAND OHIO

THE case I am about to report is I believe unique because 28 days elapsed from the time of the initial injury until the profound symptoms presented

On April 15 1923 Dr G V Crouse of Cleveland was called to see a fifteen year-old girl About 9 30 p m while sitting in a movie the patient had sudden pain in the lower left abdomen She vomited before she was able to get into the aisle and was immediately assisted to the street where she fell and vomited again She was taken to her home About midnight I was called in consultation

The patient was in shock the pupils were dilated the skin cold and clammy respirations 28 pulse 140 per minute and compressible The musculature of the abdomen was rigid The patient was conscious but in severe pain which had spread over the entire abdomen and radiating pain had extended into the left shoulder region Little history could be exacted at this time inasmuch as the patient appeared to be *in extremis* and her family knew nothing except that she had not felt well for about a month Rectal examination was negative White blood count was 14 000 and red blood count 3 700 000 The patient was moved to the hospital where hot packs were applied to the abdomen and infusion given Small doses of morphine were given On palpation of the abdomen the greatest pain was in the lower left quadrant but due to rigidity examination was unsatisfactory Anteriorly there was tympany and dullness in the flanks

Inasmuch as the patient rapidly rallied with the infusion and hot packs operation was delayed Eight hours after the onset the patient's general condition had improved the pulse dropped to 100 and the abdomen had lost some of its rigidity but the pain still persisted and had shifted more to the midline with rather marked tenderness in the right iliac fossa A definite diagnosis could not be made therefore we decided upon an exploratory laparotomy

Early April 15 8 hours after the onset under nitrous oxide plus oxygen anesthesia laparotomy was performed A high midline incision was made The peritoneum was black The peritoneum was incised and large quantities of blood and clots poured out of the wound Tubes and ovaries presented no abnormality The appendix was found to be inflamed and thickened and was removed Upon exploration of the upper abdomen a sudden gush of blood with large clots came from the left side The incision was enlarged upward and outward to the left along the border of the ribs The spleen was readily located found to be large and edematous with a rent on its outer surface which was partially

filled with clot and from which blood was flowing rapidly Splenectomy was performed and the wound closed in layers Even before the abdominal wound was closed transfusion was started and the patient received 1400 cubic centimeters of blood

Within 6 hours after operation the patient's general condition was good temperature was 100.6 pulse 110 respirations 23 From this time on improvement continued although upon several occasions during convalescence the temperature ranged to 101 Since the home conditions were such

## HEMATOLOGY OF AN UNUSUAL CASE OF RUPTURE OF THE SPLEEN

	Hemo- globin	Red blood count	Wb blood count	Differential white blood count	Per cent
Apr 5 3 p m		3 00 000	000		
Apr 6 8 00 a m	7	900 000	7 00		
Apr 6 4 00 p m	65	900 000	000		
Apr 7	80	4 500 000	5 000		
Apr		00 000	6 000		
Apr		4 000 000	5 000		
Apr 5		00 000	4 000		
May 5		6 30 000	200		
May		4 70 000	000		
May 8		00 000		P lymphocytic Large lymphocytes Small lymphocytes Eosinophiles Transitional Basophiles	44 3 7
June	80	5 000	7 000	Polynuclear Large lymphocytes Small lymphocytes Eosinophiles Transitional Basophiles	45 3 7
Aug	90	3 000	9 800	P lymphocytic Large lymphocytes Small lymphocytes Eosinophiles Transitional Basophiles	58 4 34 3
Dec 3				P lymphocytic Large lymphocytes Small lymphocytes Eosinophiles Transitional Basophiles	6
Apr				P lymphocytic Large lymphocytes Small lymphocytes Eosinophiles Transitional Basophiles	6 5

that she could not have proper care there after the wound had healed the patient was kept in the hospital 49 days and discharged in excellent condition. At no time during the patient's convalescence were there present any pains in the long bones such as are frequently described. As soon as practicable after operation a complete history was elicited from the patient.

It seems that 4 weeks to the day before the sudden onset of pain while playing at school the girl was thrown against a desk striking on her left side. The pain in the left subcostal region was severe but after lying down for a short time she was able to go home. There was still some tenderness in the left subcostal region and so she remained quiet for a few days but gave no reason to her family except that she did not feel well although she went to school daily and assisted with the house work.

From the pathological examination of the removed spleen there is no question but that at the time of the original injury she suffered a rupture of the spleen. First the rupture may have consisted of a short split in the capsule which filled with blood clot and thus the wound was tamponed until for some unknown reason a second hemorrhage occurred. Secondly the rupture was subcapsular and it took a month of slow bleeding before the capsule was ruptured at the site of the original contusion.

The opening on the surface of the spleen measured about 4 centimeters in length while below the capsule the splenic tissue was split so that it was almost in two pieces and held together by the intact capsule. The halves of the spleen were separated and a cavity almost round and about 5 centimeters in diameter was directly below the split in the capsule and into this cavity it was found a branch of the splenic artery opened.

That many cases of rupture of the spleen have not been reported is evidenced by the fact that literature on that subject is exceedingly incomplete. In a review of the literature up to 1901 I was able to find only 218 cases of subcutaneous rupture of the spleen reported. The mortality was about 28 per cent. The treatment as in every other acute condition depends upon the symptoms presented but lies between two methods, splenectomy or suture. The tampon can have no place except as an emergency measure.

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DEGENERATION OF FIBROMYOMATA OF THE UTERUS<sup>1</sup>

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FIBROMYOMATA of the uterus are probably no more subject to gross degenerative changes than are most other benign tumors which fact is noteworthy when one considers the enormous size attained by some of these tumors the large blood supply necessary for their nourishment the various degrees of pressure motility and trauma to which they are subjected and the changes which occur in the host itself during menstruation pregnancy and senility. On the other hand the types of degeneration and the different pictures presented are extremely varied. Because of this multiplicity of degenerative processes and of the names applied to them and because of their more or less indefinite relationship a group of fibromyomata showing degenerative changes and the histories of the patients were studied to determine the clinical significance of the degeneration.

During the year 1923 404 patients were operated on at the Mayo Clinic for uterine fibromyomata. Gross degenerative changes were noted in 53 specimens an incidence of 13 per cent. In all 200 specimens were available for study. As a matter of fact if microscopic sections from all fibromyomata were examined diligently evidence of slight degeneration would be found in a large number. Such change however is of little significance either pathologically or clinically. This series includes only gross degenerations uncomplicated by either carcinoma or sarcoma. So called sarcomatous degeneration is in the true sense not a degenerative process but the exact antithesis. The tumors designated as cellular or secondary hyperplasia however are probably more often degenerative than regenerative.

Gambier asserts that each fibromyoma nucleus receives only one artery that it may divide before reaching the fibromyoma on its surface or after penetrating its interior. Bardon studied the vascularization of fibromyomata by the injection of material opaque

to the rays and concluded that they had a double circulation peripheral and central. The first is very abundant and is connected with the uterine circulation by points of anastomosis. The second occurs in the form of a terminal artery any obstruction of which causes central necrosis. Sampson who carefully observed the effect of injections into arteries and veins did not verify the presence of this double circulation. He says:

In many instances only one nutrient artery was found in others two or three with one predominating. Often the only communication found between the intrinsic arteries of the tumor and the myometrium was by the nutrient arteries. In some of the medium sized and large tumors an anastomosis was found between the arterioles of the myometrium about the tumor and similar vessels in the periphery of the myoma. The single arterial supply of most fibromyomata explains why nearly all degenerative processes are diffuse affecting all parts of the fibromyoma in the same manner but the central portion more markedly as it is not nourished by the anastomotic branches around the periphery.

## HYALINE DEGENERATION

Hyaline is almost always associated with every type of degeneration in fibromyomata. Apparently it is the result of the first reaction of the tumors to an insufficient blood supply. Grossly it gives a yellow or brownish tinge to the usually white tumor and when marked increases its consistency although it is often soft and succulent. Microscopically the degeneration is seen either as a more or less diffuse hyalinization of the extracellular framework giving the characteristic homogeneous pink appearance when stained with hæmatoxylin or eosin or as sharply circumscribed bright red areas in which at first the structure appears identical with that of the surrounding tissue (Fig. 1). Later the nuclei disintegrate leaving nuclear debris.

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These areas are scattered throughout the tumor and form the site of predilection for the deposition of calcium salts. Twenty-four specimens of this group were classified as containing gross hyaline degeneration alone but even some of these were associated with edematous or cystic changes. Although hyalinization occurs in most cystic tumors it is not necessarily a primary stage in their formation; in fact the circumscribed complete hyaline areas are more resistant to cystic solution than the remainder of the tumor.

#### CEDEMATOUS AND CYSTIC DEGENERATION

The degeneration in most of the specimens was edematous myxomatous or cystic. Eighty such extremely variegated specimens were studied and since they were a part of the same pathological process they were considered as one group. In 48 of them there were actual cysts containing either a watery fluid or a gelatinous material. In 4 of the submucous type in which half or more of the tumor projects into the uterine cavity there was uncomplicated cystic degeneration. These tumors varied from a small soft intramural fibromyoma to a huge one filling the entire abdomen. The average diameter of these tumors not including the extremely large ones was more than 9 centimeters. There were several which filled the entire abdomen; one contained approximately 4 gallons of fluid.

Clinically they usually present no untoward symptoms. Because of their size urinary disturbance is common. In cases of marked degeneration the patient usually consults a physician because of recent increasing enlargement of the abdomen, sometimes accompanied by moderate soreness or tenderness. With such a history and the presence of a soft fibromyoma degeneration should be suspected. If the mass is actually cystic on palpation the diagnosis is nearly always ovarian cyst because of its far greater incidence.

The first stage of cystic degeneration is characterized by edema. Grossly this can be recognized by the decreased consistency, the crumbling and the semifluctuant or watery

appearance of the tumor. The transudation of fluid into the tissues accounts for the increase in the size of the tumor observed clinically. The cells become more spherical, larger and more vesicular; they occupy more space and in places appear to be closely packed, giving rise frequently to the diagnosis of cellular or of secondary hyperplasia. There are no mitotic figures however as Evans has pointed out the frequency of mitotic figures forms the only safe histological criterion on which to base a diagnosis of malignancy or near malignancy. On the other hand it is often impossible to determine whether one is dealing with a rapidly growing fibromyoma or with one about to degenerate. In more edematous precystic areas the cells become widely separated by non-staining fluid and may acquire a stellate appearance (Fig. 1).

Besides the increase in tissue fluids the cells themselves undergo destruction by karyolysis. The extracellular tissue which stains faint pink and is finely fibrillar increases proportionately and becomes more homogeneous just as in diffuse hyalinization. The nuclei then fade out leaving a completely homogeneous mass, grossly appearing to be an irregular cyst full of a watery fluid which on exposure to air usually becomes gelatinous or myxomatous. It is the solution of the fibromyoma itself which produces the gelatinous areas and gives rise to the name myxomatous (Fig. 2). Its chemical nature is not known but it is not true myxomatous tissue. A fine fibrillar network may appear at the very edge; this quickly disappears leaving an amorphous, lightly eosin stained center. When stained with Sudan III numerous small salmon pink fat globules are scattered around the periphery. As these areas increase in size the contents completely liquefy. Throughout such a tumor especially around and within the gelatinous areas are seen small round cells and larger mononuclears which seem to be phagocytic, often containing debris and pigment in their cytoplasm and are probably responsible for the removal of the degenerated residuum. Increase or decrease in vascularity cannot be detected with the microscope. The cyst formation is gen-



Fig. 1 (left) Edema to degeneration Separation of cells by edema  
Thrombosed hyaline degeneration It takes a bright red stain  
with hematoxylin and eosin (6)  
Fig. 2 Myomatous degeneration Karyolysis of the nuclei Replacement by  
homogeneous mass Section of large multinucleated cells are visible (x 100)

eralized but more evident in the center of intramural fibromyomata and in the central distal part of pedunculated ones. The discrete necrobiosis of only a portion of a tumor with resulting cyst formation is indeed very uncommon.

The picture of cystic degeneration is often complicated by hyaline degeneration, thrombosis, hemorrhage or calcification. Thrombosis and hemorrhage are frequent variations. A generalized myxomatous tumor may contain numerous reddish speckled areas due to visible vessels or it may be streaked by extravasated blood either into the tissue or into the gelatinous material showing a beautiful multicolored surface on cut section (Fig. 3). The cyst may contain bloody fluid or blood clots adherent to the walls. Microscopic examination reveals that all the discoloration is due to extravasated red blood cells and blood pigment due in turn to the ever present thrombosis.

#### RED DEGENERATION AND TOTAL NECROSIS

Red degeneration of fibromyomata is so called from the red color imparted during necrobiosis. Although it is a gross diagnosis this type forms a separate fairly well defined group distinguishable to a certain extent both clinically and histologically. It is frequently associated with pregnancy. Bland Sutton reports 40 cases, 26 of which were associated with pregnancy and says the change is more frequent, more intensive and more extensive

when associated with pregnancy. The Mayo Clinic group included 33 specimens, 23 of which gave evidence of a rather recent necrobiosis (typical red degeneration), 10 were associated with symptoms referable to the degeneration and 5 only were associated with pregnancy. These statistics however are of little value because relatively few pregnant women come to the Mayo Clinic and because the frequently emergent nature of the accident prevents traveling any great distance. Of the 10 patients presenting symptoms of degeneration only 2 had had recent severe pain.

The symptoms vary from a dull ache or soreness with weakness, fatigue and lassitude to a sudden attack of acute pain with a tender mass and a mild fever and leucocytosis. The symptoms depend on the acuteness of the necrosis and on the size of the tumor, the two factors which determine the amount of autolytic toxic material thrown into the blood stream.

Grossly the specimens may present patchy red streaks (Fig. 4), a red central portion or a diffuse red, reddish brown or brown discoloration (Fig. 5). Schuller reports a case in which the necrosis and discoloration were entirely peripheral but usually the whole fibroma is involved (Fig. 6). The most necrotic ones give off an odor as of decaying animal matter. Their consistency is soft and possibly crumbling and necrotic but absolutely homogeneous with no evidence of actual cyst formation. The dry nature of the



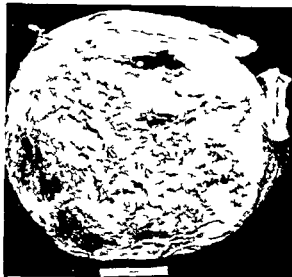


Fig 3 (left) Cystic degenerated myomatous specimen with thin bag



Fig 4 Red degenerated specimen. Pathologic discoloration from fatty tissues usually

tumors on section is more or less characteristic. It is conceivable that a tumor like that in Figure 6 would ultimately form a cystic mass full of chocolate colored material but this one after fixation in formalin formed a surprisingly solid firm homogeneous mass. This solidity of structure is more evident in the fixed specimens without cyst formation. On the other hand red degeneration can be definitely traced through the stages of brown, gray and yellow degeneration and ultimately to calcification. The red may persist even to the stage of calcification and give rise to the diagnosis red degeneration and calcification. Usually it becomes a lighter dirty gray or yellow often with yellow or bright orange streaks around the periphery. Later calcium salts are deposited around the whole circumference. Murray likewise has noticed this transition.

Microscopically red degeneration is characterized by patchy or sometimes complete fatty necrosis with thrombosis of the vessels, extravasation of red blood cells and deposition of blood pigment. Several investigators have cultured this type of fibromyoma for organisms. The consensus of opinion has been that the necrosis is not a septic process. If infection does occur it is secondary and of

grave import. In none of these specimens was there microscopic evidence of infection. Marked vascularity was a striking feature. Numerous blood sinuses sometimes formed an almost angiomatous mass. Most of the sections showed thrombosis and in all there were extravasated red blood cells and blood pigment. Sudan III stain revealed a remarkable amount of lipoids which sometimes form red crystalline deposits. Round cells, large mononuclear cells and even a few polymorphic leucocytes infiltrated the tissues to a moderate degree. The picture was what would be expected if the venous return had been obstructed but on the other hand torsion of pedunculated tumors presents a different histological picture. Figure 6 represents a pedunculated fibromyoma with typical red degeneration produced by torsion of the pedicle. Among 71 specimens of fibroma of the ovary 2 were found with red degeneration due to torsion. One with a patchy red discoloration had caused a severe attack of pain 3 weeks before and torsion of the pedicle had been diagnosed. In a second case the history suggested attacks of torsion over a period of 3 years the last attack 2 weeks before. At operation the pedicle was found to be twisted  $2\frac{1}{2}$  times. It had a general red to blue color

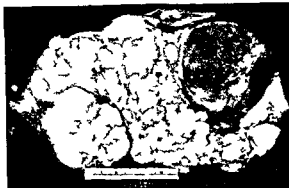


Fig. 5. High magnification of a section of a specimen of which is undergoing degeneration. The section shows a typical degenerative change in the structure of the specimen.



Fig. 6. Typical elongation in a specimen of the specimen. The section shows a typical elongation in the structure of the specimen.

and histologically proved to be similar to red degeneration of uterine fibromyomata.

Sampon (9) by injecting the arteries of a fibromyoma has shown that the arterial supply is very abundant even more so than that of the uterus itself while by similar injection into the veins he was able to demonstrate only a very scant venous supply. This insufficient venous drainage with an overabundant arterial supply would predispose to incomplete or complete venous stasis during the congestion consequent on pregnancy venous obstruction thrombosis by torsion pressure or uterine contraction. If the main artery alone were blocked one would expect to find necrosis due to anemia with possibly some discoloration around the periphery. There is apparently a profound stasis in the circulation and histologically it appears to have arisen chiefly by a sudden blocking of the venous rather than the arterial blood. Murray has emphasized the hemolytic action of the lipoids and believes that thrombosis is secondary to this action that it occurs within the vessels and is followed by extravasation of the pigment. It is more probable however that hemolysis occurs in the usually abundant infiltrating red blood cells.

Smith and Shaw in a series of cases correlated the symptoms with thrombosis because they observed that thrombosis was more marked when there were many symptoms and usually absent when there were no symptoms. Increased thrombosis may in

dicate merely a more acute process. In a group of 5 specimens in which enormously dilated sinuses filled with thrombi dotted the whole surface there was very little discoloration no diffuse discoloration and very little necrosis. None of the patients had had symptoms. The thrombi were in every stage of formation indicating a relatively slow progression which may account for the very slight necrosis.

In discolored fibromyomata in which necrosis is more complete the cut surface will show a brown tinge and later a gray or dirty yellow. In the latter microscopy reveals almost complete necrobiosis and an amorphous mass with still visible blood sinuses old disintegrating red blood corpuscles and a much lesser amount of hemosiderin. Sudan III stain demonstrates large amounts of fat. At this stage chiefly in the periphery yellow or bright orange streaks are common in some imparting a bright yellow to the whole cortex as in 10 cases of this series. With hematoxylin and eosin stain the color is always due to a deposit of bright yellow pigment in amorphous or crystalline form (Fig 7). In the earlier stages hemosiderin appears in similar amorphous clumps. Variations from these black amorphous to brown amorphous to yellow crystalline deposits can be observed. They stain neither for fat nor iron and are presumably composed of hamatoidin. When it is present there is usually either gross or microscopic evidence of calcification.



Fig. 7. Hematolymphoid infiltration in a totally necrotic tumor. The old blood is seen containing integrated red blood corpuscles still viable.

#### CALCIFICATION

Calcification occurs in two forms (2). That following red degeneration or total necrosis is characterized by complete necrosis of the tumor with a tough yellowish center and a deposit of calcium around the periphery. Here the most favorable foundation has been laid for calcification that is an irremovable mass of dead tissue with fatty degeneration. Klotz described calcification as a process preceded by the formation of neutral fat and later of fatty acid with which the calcium from the blood and lymph forms insoluble soaps. Wells does not agree with this view. He however admits some association between fatty degeneration and calcification. It is commonly stated that these fibromyomata die in their own coffins, that the encircling rim of calcium shuts off the circulation and causes death, but all of the evidence indicates that the fibromyoma is completely necrotic long before calcification occurs. Of 39 specimens 30 were of this type (Fig. 8). It is interesting to note that 2 patients with a single interstitial calcified fibromyoma which acted merely as a foreign body chiefly complained of severe menorrhagia which must have been due purely to the mechanical effect of the dead mass.

The second form of calcification occurs as the deposit of hard yellow bony like material scattered throughout the tumor or confined to separate lobules or degenerated areas (Fig. 9).



Fig. 8. Calcified fibroid uterus. A reddish brown necrotic interstitial fibromyoma.

The resemblance to bone is striking. Heterogeneous bone has often been noted in fibromyomata in these specimens however even after numerous microscopic sections a positive diagnosis of bone could not be made but a deposit of calcium on a non cellular fibrous framework remained after decalcification. The deposition may occur in any part of the necrotic tumor but it has a distinct predilection for the circumcribed bright red stained hyaline areas. The interstitial tissue remains in fair condition. This type of calcification differs from the former in that the calcified areas look and feel like bone and are either distributed throughout the tumor like cancellous bone or confined to one section and there is no encircling rim of white hard layers of calcium. The necrosis is not total.

The average age of the 39 patients was 50 years. The average age of the whole series was 44. One patient only had symptoms due to the degeneration itself. The tumor (Fig. 9) had been present 35 years and had produced numerous attacks of acute abdominal pain. The operation was performed during a very severe attack and this large stony tumor with a torsion of its pedicle and a complete axial rotation of the uterus and adnexa was found.



Fig. 9. Pedunculated tumor weighing 9 pounds, the bony-like cauliflower-like surface which produced a rotational motion of the uterus.



Fig. 10. Cut section weighing 6 1/2 grams, peripheral infection and necrosis in a submucous pedunculated fibromyoma.

#### INFECTION OF SUBMUCOUS FIBROMYOMATA

The infected pedunculated submucous fibromyoma gives a distinct pathological picture which obtains in no other type of degenerated tumor. There were 13 specimens in the series studied. Grossly the tumor was a foul smelling gangrenous mass covered by hemorrhagic necrotic tissue. On the cut section it was seen that the central part was fairly solid and white and large dilated thrombosed sinuses passed through it (Fig. 10). The cortex consisted of a layer 1 or 2 centimeters in thickness of intensely black hemorrhagic material. Microscopically this black rim beginning at the periphery consisted of a fibrinous layer soon infiltrated by large numbers of polymorphous leucocytes and a great deal of extravasated blood around numerous blood sinuses. There was an organization of thrombi in the sinuses and likewise of extravasated blood with pigmentation by hemosiderin almost everywhere. The center of the fibromyoma was oedematous or hyaline. The clinical symptoms of this sort of tumor are likewise characteristic. The patients usually at the climacteric have had marked menorrhagia, none of them for more than 3 years and most of them for less than a year. They

have had metrorrhagia and the characteristic watery discharge. They are invariably anaemic in a weakened condition and frequently require transfusions.

Sampson (10) asserted that the mucosa over a submucous tumor becomes atrophied with the resultant disappearance of the glands and vessels and it is not the seat of the bleeding in menorrhagia. A different situation arises at least when degeneration and infection occur. The whole periphery is a mass of blood sinuses from which bleeding can arise with the greatest ease. The thrombosis of the veins of the central part can easily produce sufficient venous stasis to aid materially in the hemorrhage. This is not an acute process as evidenced by the old organized pigmented thrombi. In fact it is possible that the necrosis has been gradually advancing during the entire period that the patient has had marked symptoms that is several months or years. In these cases the myoma presented at the cervix and all bleeding promptly ceased after vaginal myomectomy.

#### SUPPURATING FIBROMYOMATA

In all there were only 3 cases of infection other than that in the pedunculated sub

mucous type of tumor. One was a subcervical about 15 centimeter in diameter in a woman of 8 years who was 5 month pregnant. Moderate discomfort and bladder irritation were the only symptoms. The contents of the cyst were semipurulent and the walls showed definite evidence of infection. The second cyst was a tumor in the right broad ligament containing an abscess which opened into the ileum 3 years after the menopausal period. The abscess may have arisen by contiguous infection from the ileum but it is more probable that it opened secondarily into the ileum. The third case was that of a woman of 42 years who had had moderate pelvic discomfort for 6 months. On opening the abdomen free fluid was found with evidence of considerable inflammatory reaction. In the very center of the tumor which was 14 centimeters in diameter there was a small red area similar grossly to that of red degeneration but microscopically appeared to be a true inflammatory process. Nixon drew attention to the rarity of infection in fibromyomata and reported only 1 case in 1000 operation for fibromyomata by Deaver. The 3 cases in this series were found in 6500. The statistics on the early cases are not absolutely accurate and the actual incidence was probably higher, however it indicates the relative infrequency of the complication.

#### FIBROLIPOMATA

Two tumors were encountered which had been diagnosed as degenerative and which on microscopic examination showed collections of fat in cellular spaces identical with fat deposited in any part of the panniculus. They showed no degenerative change and appeared as a distinct type of tumor that is a fibrolipoma.

One tumor was found with a tuberculous ulceration acquired by contiguity from tuberculous of the fallopian tube.

#### REMOTE EFFECT OF DEGENERATION

For years it has been repeatedly asserted that fibromyomata particularly when in a state of degeneration produce a deleterious effect on the heart. In this series there were but 1 patients in whom any affection of the

heart was noted in the routine examination. Two of the 6 were in a state of decompensation others revealed marked generalized arteriosclerosis and 2 were cases of mitral stenosis. A larger number of patients complained of dyspnea which might easily have been due to either the anemia or the large size of the tumor. In 10 other patients the systolic blood pressure was elevated above 155 millimeter. A total of 2 patients or about 10 per cent showed evidence of cardiovascular disease. As regards the urinary tract 3 patients had albuminuria 1 of whom died from nephritis a few months after operation. 2 had hydronephrotic right kidney presumably due to pressure of the tumor on the ureter. 6 had a persistent pyuria from cystitis. The effect of a degenerating fibromyoma on the general health is certainly not marked. With real degeneration there is definite evidence of toxic absorption which may continue for several months producing symptoms of mild toxemia. In the necrotic submucous type the patients are very anemic from the direct loss of blood and may also have the usual symptoms of a subacute focus of infection namely anorexia, malaise, fatigue and a low fever. Suppuration in a fibromyoma of course produces rather serious symptoms. With these exceptions there is no demonstrable constitutional effect from degeneration of a fibromyoma.

#### SUMMARY

60 degeneration occur in approximate 15 per cent of fibromyomata. Two hundred specimen of grossly degenerated fibromyomata of the uterus were reviewed and the degeneration classified as follows: hyaline 4 cases, edematous 33 and myxomatous 80. Red degeneration with total necrosis 33, calcification 30, infected abscessous and interstitial 3 and submucous 13. Mucellaneous thrombotic mass 5, tuberculous 1 and fibrolipomatous 2.

Edematous cystic and myxomatous degeneration are a part of the same pathological process probably due to a gradual diminution in the blood supply. There are no clinical symptoms peculiar to it.

Red degeneration is an aseptic necrosis characterized by fatty degeneration throm-

bo is of the vessel extravasation of red blood cell and blood pigment. Pathologically it is a red infarction and can be explained by a sudden complete vascular obstruction affecting chiefly the venous system. The end result is a total fatty necrosis with transformation of the hemosiderin into hæmatoidin and subsequent calcification. The occurrence of symptoms depends on the size of the tumor and the acuteness of the necrosis. There is local pain and tenderness and a mild toxæmia.

Infection following necrosis of a submucous fibromyoma is very distinctive and probably accounts in itself for all symptoms.

Calcification which occurs in two forms the peripheral deposition in a totally necrotic fibromyoma and the bone like formation scattered throughout the tumor has little clinical significance.

There is little evidence that the degeneration of fibromyomata produces a toxic effect on the other organs.

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## FURTHER EXPERIENCE IN CANCER OF THE BREAST

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FOR several years I have been writing articles on the results obtained after operations for mammary carcinoma. The percentage of 5 year absence of symptoms has been higher than the facts seem to warrant. In all probability in these former reports some cases may have been included the malignancy of which was doubtful and thus the percentage of 5 year cures claimed has been higher than it should have been.

In the present review of cases I have tried to do away with this element of error by ruthlessly excluding from consideration all cases about which there could be the least doubt. Each case which has been included in the group reported must fill the following requirements: first it must be clinically malignant; second it must present macroscopically the appearance of carcinoma; third it must satisfy the pathologist by presenting the microscopic picture of lawless epitheliomatous activity. Several cases which seemed clinically malignant even having the gross appearance which confirmed the clinical diagnosis were found by the pathologist to lack sufficient evidence. In a good many cases which the pathologist pronounced carcinoma clinical evidence was not sufficient to confirm the diagnosis. These cases have all been thrown out and only those used that meet the rigid requirements laid down.

Only one exception has been made to this rule even though a case might not pass muster as carcinoma if the operation was followed by recurrence and death the condition obviously must have been carcinoma in the first place and raises the death rate. Two cases of this kind are included which would have been excluded if the patients had recovered. It is probable that some that have had no recurrence and were not counted because of lack of complete evidence were really suffering from carcinoma and should have been given places in this series. It is certain there are borderline cases in which pathologists may have an honest difference of opinion.

Until 1910 all of my cases were not subjected to this rigid set of rules. Therefore although many patients with undoubted carcinoma of the breast operated upon before 1910 are clinically well at the present time they are not counted in this analysis. The group now under consideration includes all the cases of proved cancer operated upon by me during the years 1910 and 1919 inclusive. None of them therefore has survived more than 15 years or less than 5 since operation.

The number is not large but it is believed that it presents a fair group for study. After excluding the only operative death a woman of 70 who died of acute nephritis there are 113 patients in the group. Of these 96 have been traced and seen or heard of recently and 17 have been lost sight of. Of the 96 patients traced 49 have died of cancer, 4 are now suffering from recurrence of metastasis and 43 are alive and well with no sign of local recurrence or metastasis. This gives a percentage of 44.8 that have been free of recurrence from 5 to nearly 15 years.

Of the 49 fatal cases 30 had definite carcinomatous involvement of the axillary glands as noted at the time of operation and in several of them the disease was so far advanced it is probable my judgment was at fault in operating upon them. In very few of the cases now well was enlargement of the axillary glands noted the constituting another strong argument in favor of operation before the axilla is involved.

In 47 of the fatal cases I have learned that the average length of time elapsing between the operation and death was 3 years and 13 days. Three of the number died within 6 months, 10 between 6 and 12 months, 11 between 1 and 2 years, 10 between 2 and 3 years and only 13 lived more than 3 years after the operations. The one who lived longest survived operation 4 years and 24 days. With this showing it is questionable whether operation is advisable when the disease is so advanced that hope of cure is nil. I seriously

question whether patients who cannot be expected to be cured should not be advised to have palliative X-ray treatment and saved from the ordeal of a radical operation. It is certain when the disease is so extensive that cancerous tissue is cut into during the progress of the operation the fatal issue is likely to come earlier than if no operation had been done.

All advanced cases should be subjected to a most searching physical examination and an X-ray of the thorax and skeleton to determine as far as possible whether any metastases are present. An unexpected metastasis may occasionally be discovered thus positively deciding one against operation. In many of the fatal cases it has not been possible to ascertain the exact cause of death but 4 have been recorded as having had metastases in the liver and 6 in the lung.

It may be of advantage to review briefly the condition of the 4 cases now suffering from recurrence all of whom I have seen recently.

**CASE 1** Mrs L W age 50 years was operated upon November 18 1915. A mass had been noted in the lower outer quadrant of the left breast 8 months before her operation. There was no retraction of the nipple no fixation to the skin or underlying fascia and no involvement of the axilla noted. Apparently at the time of the operation she seemed to have a good prognosis. I examined her at my office June 1 1924 and she was found to be suffering from a very extensive local recurrence the whole left side of the thorax being implicated in a dense nodular infiltration with a small area of ulceration at about the middle of the scar. Radiation treatment was a fiasco but she is failing. It has now been a little over 9 years since her operation.

**CASE 2** Mrs T V C age 45 years was operated upon March 10 1916. A lump was noted in the left breast 5 months before. Though there was slight axillary involvement it did not seem to be a very advanced case. About a year later I removed a small nodule which had appeared in the scar. Healing was complete and I saw her several times between the operation for recurrence and October 2 1924 when she came to my office and I noted a hard fairly movable mass in the subclavicular region also a small firm mass at the lower part of the axilla somewhat fixed and another small mass at about the middle of the scar firmly fixed to and involving the rib. As the recurrence seemed too extensive to be amenable to surgical treatment I advised X-ray and I thought it would be advisable to combine radium treatment with the X-ray. She has survived 8 years since her first operation.

**CASE 3** Mrs E M C age 59 years operated upon May 16 1919. The condition was somewhat advanced at time of operation with slight enlargement of the axillary glands. She was seen at my office September 24 1924. She came in response to my letter inquiring about her condition. A hard mass 2 centimeters in diameter was found at the apex of the axilla firmly adherent to and already involving the skin. There was also a pea sized nodule at the middle of the scar firmly fixed. She was sent to the radiologist.

**CASE 4** Mrs G B age 46 years was operated upon November 21 1919. She first noted a mass in the outer part of the left breast 3 months before she consulted me. The nipple was retracted but no notation made of the condition of the axillary glands. I did not hear of her until August 29 1924 when she came to my office and was found to have a bone metastasis in the upper third of the right femur proved by the X-ray.

Several other cases may be noted briefly because of facts of special interest pertaining to them.

**CASE 5** Mrs C H V age 28 years was operated upon July 11 1917. She came back and was operated upon for rather extensive local recurrence February 15 1919. About a month after her discharge from the hospital she died of flu pneumonia. Because of the recurrence she is counted as a cancer death.

**CASE 6** Mrs J H N age 42 years was operated upon December 3 1919. She also died of flu pneumonia March 24 1922 but as she had local recurrence at the time she too is counted as a cancer death.

Three were operated upon first for cancer of one breast and came back later with cancer developed in the other breast.

**CASE 7** Mrs H L I age 54 years was operated upon February 8 1911. A mass the size of a dollar was present in the upper inner quadrant of the left breast. Twenty months later she came back with local recurrence in the operative scar and carcinoma of the right breast. December 27 1912 radical operation was done on the right side and the recurrent nodule removed from the left side. She died of extensive local recurrence in May 1913 only 5 months after removal of the left breast.

**CASE 8** Mrs D B C age 48 years was operated upon November 14 1913. No glands were noted in the axilla. She returned with cancer in the outer upper quadrant of the left breast and this was removed by radical operation March 8 1917. It will be noted that 3½ years intervened between her first operation and the development of the disease in the opposite breast. She is alive and thus far free of recurrence.

**CASE 9** Mrs F S age 50 years was operated upon January 11 1915. This was an advanced case.



of carcinoma of the left breast with axillary involvement. Just a year later cancer developed in the right breast and it was radically removed. She died of lung metastasis about 18 months after the second breast was removed.

**CASE 10** Mrs C R, age 61 years was operated upon June 21, 1910. A large mass was present in the right breast with a large adherent mass in the axilla. In clearing the axilla the axillary artery was torn and an effort made to repair the rent by suture. For a day or two the radial pulse could be felt but later it failed and gangrene of the entire right forearm occurred for which amputation was done through the middle third of the humerus July 6, 1910, 15 days after the mastectomy. She recovered promptly and went home but died of local recurrence in May, 1911, 11 months after her operation.

Here is a case of very rapid development and an unusually early fatal outcome.

**CASE 11** Mrs M A, age 40 years was operated upon May 12, 1919. She was very sure the mass did not appear in her left breast until 2 months before her operation. Some axillary glands were enlarged but not adherent. There was very rapid local recurrence and she died in August, 1914, about 3 months after the operation and 3 months after the first appearance of the nodule in her breast. The question arising here is: Was this a case of unusual malignancy, or weak resistance, or did I implant cancer cells during the progress of the operation?

All but one of the cases in the series occurred in females. The one male has some points of interest worthy of note.

**CASE 12** Mr J S S, age 57 years was operated upon June 18, 1915. He had noted a hard painless nodule growing gradually in the right breast for 3 years and 9 months. The mass was found to be the size of a golf ball, very hard and fixed to the skin. There was also a mass of hard movable glands in the axilla. He came back twice later with local recurrences which were removed and finally died of extensive local recurrence and metastases, October 8, 1918. Postmortem showed nodules in the supra- and infra-clavicular regions, also in the liver and intestines.

The general plan of treatment of mammary carcinoma is very generally agreed upon by leading surgeons, but there are a few points that may be stressed with profit.

1. We all know too well what a high percentage of cases reach the operating table so late that the chance of cure has been seriously jeopardized. Strenuous pushing of the educational campaign carried to the public by the American Society for the Control of Cancer is

inducing many women who have discovered a lump in their breasts to consult their physicians promptly. In this respect a great deal has already been accomplished.

It is my conviction that a very brisk campaign among the members of the medical profession is equally important. How often a lump in the breast is treated lightly by the physician when he is first consulted. I would not stop this campaign until every practicing physician regards every lump in the breast as malignant until it can be proved benign. I do not intend a criticism that is unkind. We must remember that when the surgeon is consulted the patient has passed the gamut of the family physician and comes to us as a court of last resort. Naturally we feel the weight of the responsibility put upon us and even then it is often difficult to decide for or against malignancy. It must be remembered that the family physician is dealing with a regular patient, probably an old friend, and often he has been called to see another member of the family, and while there the wife or mother casually remarks that she has something ailing her breast. She often makes light of it because she wants to be reassured. After a very perfunctory examination or frequently none at all, the anxious one is told not to worry or borrow trouble. With this assurance such a patient will often go for months because she has had her apprehension relieved. In the meanwhile the malignant process, not being susceptible to this form of hypnosis, goes right on infiltrating surrounding tissues and invading the lymphatic channels widely in every direction. Finally this unfortunate woman, seeing that the nodule is growing, again consults her family physician or some other physician and is shocked by being told that she has cancer.

When she finally reaches a surgeon he will probably find retraction of the nipple, involvement of the skin, fixation to the underlying tissues, some hard glands in the axilla and possibly metastasis to the thoracic cavity, the liver or the bones. This is not a fanciful picture but an everyday occurrence. It would be much better for the physician to be an alarmist than a procrastinator when the question of cancer is involved. I have much

more respect for the physician who sends me a case of simple mastitis with the diagnosis of cancer than for the one who refers a case of advanced carcinoma with a note saying

This woman is overanxious so I am referring her to you to be reassured' Every woman with a suspicion in her mind that something is the matter with her breast is entitled to the most careful painstaking examination of which we are capable

I am more than ever convinced that every lump in a breast should be regarded as potentially malignant until it is proved to be benign and that every benign lump in the breast if well defined should be removed and subjected to careful microscopic inspection There are occasional surprises in even the most innocent looking breast tumors

2 No radical operation is justifiable until there is a practical certainty that carcinoma is present In doubtful cases careful inspection of the gross specimen should be made and a competent pathologist should make a microscopic examination of a frozen section If this method were generally followed many breasts now removed radically would be preserved and some in which a supposedly benign growth is removed would be treated radically

3 I am convinced that when the case is much advanced the usual procedure needs modification The question Is this case curable by operation? is a big one and often hard to answer It is folly and utterly inexcusable to subject a woman to radical removal of a breast when she is already suffering from a distant and incurable metastasis It is therefore important that these patients should be searched in every available spot by all the ordinary methods of physical examination including the X ray By this means it is possible to determine lung and bone metastases unless they are very early and not yet capable of throwing a shadow It is also important to determine if the liver is enlarged and especially if it is nodular I am also convinced that when the mass is firmly fixed to the chest wall or there is a fixed mass of glands in the axilla or there is a definite involvement of the supra clavicular gland that no operation or treatment yet devised will

cure the patient and I believe that in most cases patients with cancer thus advanced will die sooner if operated upon than if treated palliatively or let alone

4 The type of operation performed when operation is indicated is of the greatest importance I have written extensively and perhaps offensively on this subject before but am impelled to say again that operations for breast cancer are often done in such a way as to do more harm than good If the malignant tissue is cut and traumatized during the progress of the operation it will probably result in hastening a fatal issue by implanting the disease upon healthy tissue The rule to cut wide of all tissues that seem in the least suspicious is a safe one and not difficult to carry out if the case is really operable The radical operation if properly carried out does not furnish the surgeon a chance to see any cancerous area from the beginning to the end of the operation The lymph bearing fascia is always under suspicion and the widest removal possible should be the rule This means the sacrifice of the fascia to the opposite border of the sternum the fascia covering the serratus magnus and the aponeurosis covering the upper end of the rectus abdominis and the obliquus externus All this extensive area is to be removed in one sheet and it should not be cut at any point except at the extreme limits of the area removed

The axillary dissection is important No rough handling and no tearing are permissible Complete exposure by first cutting the humeral insertion of the sternal portion of the pectoralis major and the coracoid insertion of the pectoralis minor will insure good visual access to this most important zone By beginning at the very apex of the axilla and dissecting the fat and glands in one mass and using a very sharp knife every act being guided by the eye it is surprising how easy it is to clear the axilla This dissection may be carried medially to include the subclavicular group of glands with their enveloping fat

5 One of the most troublesome post operative conditions from the standpoint of the surgeon and of the patient if she lives in the neighborhood is an arm with limited motion prone to swell and become painful

Without going into a discussion of the causes of these disagreeable sequelæ I want to say that much of this distress may be prevented by one or two very simple expedients. By keeping the arm at a right angle to the thorax during the first 8 or 10 postoperative days by fitting a good sized pad of gauze and by means of adhesive strips pressing this pad firmly enough to eliminate the axillary space and by instructing the nurse to see that the patient moves her forearm and arm many times daily putting the hand to the top of the head and combing her own hair as soon as possible there will usually be little trouble about arm motion and the arm will rarely swell or become painful. Since carrying out all these details there have been very few complaints of painful swollen or immobile arms. Patients with cured carcinoma of the breast consider themselves sufficiently maimed because of the loss of the breast without also having troublesome arms.

6 If we are ever going to reach any definite conclusions concerning the care of cancer of the breast it will be necessary to know our results. It is urged in the interest of our patients and of future generations of patients that we keep in as close touch with their progress as possible. They ought to be encouraged to report for examination as often as possible. Every month for the first 3 months then every 3 months for 2 years or more and after that every 6 months for as long as possible they should report either to the surgeon or to the family physician. A careful follow up on these cases is the only method of finding out exactly what we are accomplishing.

Finally in studying the subject of cancer one becomes more and more impressed by the difference in results depending on the degree of advancement of the disease at the time of operation. To make for greater accuracy a standardized method of grouping the cases would be helpful in reaching conclusions of value.

#### SUGGESTION OF GROUPING

Here is submitted a tentative suggestion of groups based on the local condition and not on the duration of the disease.

Group 1 The very early case. This will include those with a nodule with no pucker

ing of the skin no fixation of any kind and no palpable glandular enlargement. Manifestly this group will require exploratory incision and microscopic evidence to make the diagnosis. A very high rate of recovery 85 to 90 per cent is to be expected in this group.

Group 2 The early case. Here the preoperative diagnosis is more certain. There is some puckering of the skin the outline of the mass is a little less definite the perfect normality of the neighborhood tissues is not so easy to confirm but there are no enlarged glands to be felt. The clinical and macroscopical examination will usually determine the diagnosis but in some cases the microscope will be a necessary aid. The prognosis is still good but a little less favorable than that in Group 1.

Group 3 The midline case. In this group the diagnosis is still more apparent. The puckering of the skin is pronounced. Examination of the axilla may leave one in doubt. If the mass is centrally located retraction of the nipple may be present. A fairly positive preoperative diagnosis can be made and where the mass is cut across it will show the characteristic cancer appearance. A good percentage of these cases should be cured by operation.

Group 4 The advanced case. One or more of the following conditions will be present. The skin will be sufficiently involved to move with the mass there will be definite fixation to the deeper tissues or a positive involvement of the axilla will be manifest. The prognosis is much worse and will be somewhat affected by the presence of one or two or all of the conditions named.

Group 5 The very advanced case. This group includes cases the diagnosis of which may be made by the tyro. The mass is much fixed. There may be discoloration of the skin or even ulceration over the mass and the axilla contains hard masses more or less fixed. The prognosis of the members of this group will be very bad much worse I believe than most of us have been led to believe.

Group 6 The inoperable cases. Absolute fixation of the breast to the thoracic wall carcinomatous thickening or nodules extending widely over the chest extensive ulceration

a fixed mass in the villa a definite involvement of the supraclavicular glands and more or less wide spread metastases make the case eligible to this group. Any or all of these conditions render the case hopeless. Only palliative treatment is to be suggested for this group.

It is my opinion that as the results are studied more and more of the cases in the very advanced group will be transferred to the inoperable group. I am losing confidence in the value of surgery in the cases that already show widespread infiltration.

If we could get on a working basis following out the principles of this tentative grouping I believe it would be found that as the members operated upon in the first and second groups increase as they are bound to do a more optimistic spirit would prevail and the spirit would filter down into the ranks of the layman and as a result still larger numbers would come for early operation. As a corollary to this the number reaching the surgeon in the advanced very advanced and hopeless state would decrease almost to the vanishing point.

## THE TREATMENT EMPLOYED IN ONE HUNDRED AND TWENTY-FIVE CONSECUTIVE CASES OF HEAD INJURIES<sup>1</sup>

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**I**N view of the fact that only 22 deaths in a series of 125 cases of serious head injuries occurred during the past 2 years on the neurosurgical service of Dr. Charles F. Dowman at the Grady Hospital, Emory Division and in our private practice a discussion of the principles underlying the diagnosis and treatment employed seems justifiable. As operative measures were employed in only 36 of these cases the character of treatment employed in a relatively large number of the so-called non-operative cases will be particularly discussed. As this treatment is based upon certain fundamental facts proved by experimental observation a brief review of the experimental evidence will be given.

Some 113 years ago when John Abernathy wrote his monograph entitled "Surgical Observations on Injuries of the Head" in protest against the propriety and necessity of trephining the cranium under various circumstances consequent upon injuries of the head as had been taught the surgeons of their respective countries by the members of the Academy of Surgery in France and by Mr. Lott of England he probably little realized that he had voiced some principles and procedures which a century later would be developed and perfected into a scientific and successful treatment of brain injury.

When we consider that his monograph appeared before Simpson had recommended chloroform as an anesthetic or Crawford Long had discovered ether and previous to the researches of Tyndall, Pasteur and Koch upon which Lister based his investigations leading to the introduction of antiseptics we can readily see how apropos were his suggestions. In the light of present day results in the management of these cases we can but marvel at the benefit to humanity that would have resulted during this span of one hundred years had his teachings been accepted and developed.

Several cases described by him fit accurately into classifications used today while his suggestion of conservatism in operation and the administration of salines form the sheet anchor of our treatment in a certain large class of non-operative cases.

Though he recognized in a practical way the existence of that clinical entity which we know as intracranial pressure and though much scientific work was later done on the subject by Cromer, von Bergman, von Schulten, Kocher and Leonard Hill it was left to Harvey Cushing to furnish us the knowledge of intracranial pressure and to stimulate the experiments of Weed, McKibben, Foley and Utman on hypertonic solutions that were des-

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tioned to point the way to the treatment to be outlined in this paper

For the successful management of symptoms and complications arising from injuries to the brain either with or without fracture of the skull there must be a clear understanding of the principles involved an accurate mental picture of the symptoms following different conditions such as depressed fracture meningeal hemorrhage different phases of intracranial pressure and a logical classification from the standpoint of pathological physiology the condition of the brain and its membranes being taken into consideration rather than the obsolete classification of the different forms of fracture of the skull

In a paper of this scope it is impossible to consider in detail the various experiments made by different investigators at different times on intracranial pressure so for practical purposes it will suffice to mention Cushing's deductions from observations and experiments regarding this important clinical manifestation

Though interesting experiments were made with local pressure the most valuable work was done on general pressure Through a glass window fastened into a trephine opening Cushing<sup>1</sup> made observations on the effects of intracranial pressure on the blood vessels as to color size etc and showed clearly that pressure symptoms depended on circulatory disturbances and not compressibility of brain tissue From his experiments the three following important facts were brought out (1) Under compression the obstruction to the circulation begins at the venous side and extends backward toward the arterial side the venous blood is kept inside the cranium and as the veins are the natural exit for cerebrospinal fluid this in turn becomes stagnated and adds to the compression by the resulting hydrocephalus (2) After the veins are pressed empty the capillaries and arterioles are gradually emptied thereby bringing about anæmia exactly at the moment when the force of the compression exceeds the blood pressure (3) The anæmia in the medulla stimulates the vasomotor center which drives the blood pressure above the compression level If com-

pression pressure be elevated still higher the same cycle is repeated until one or two results will ensue either the compression gradually lowered with an attendant and parallel lowering of blood pressure or the compression will continually increase until the vasomotor center is forced to give up the struggle and the blood pressure literally tumbles down in its lead to a fatal issue

While it is true that paralysis of the cerebral cortex may be borne for a long period without direct danger to life it is equally true that a persistent anæmia of the bulbar centers must eventually lead to death through paralysis of the vasomotor centers Fortunately an anæmia of the vasomotor center immediately causes through the splanchnic vessels a rise in blood pressure sufficient to drive blood through the capillaries thereby temporarily relieving the anæmia and postponing the inevitable fatality resulting from a persistently increasing pressure So we see that the sole hope and the imperative procedure in a certain large class of cases is the anticipation of this increase in intracranial pressure and the institution of appropriate remedies to prevent it or if the patient is seen after the pressure has been established it is the correct treatment to relieve the condition before permanent damage has been done

The condition of brain anæmia and the dangers attendant upon increased intracranial pressure have been recognized more than 20 years but the scientific treatment for the relief is of very recent development

In 1919 Weed and McWhibben (8) in studying the pressure changes of the cerebrospinal fluid of animals following intravenous injections of solutions of various concentrations noticed when they attempted to recover sodium chloride from the spinal fluid (after injections of hypertonic salt solution) that spinal fluid could not be obtained from the subarachnoid space By using a manometer they noticed that pressure of the cerebrospinal fluid would be altered very rapidly by injections of hypertonic salt solution After making this observation injections were made of isotonic hypotonic and hypertonic solutions cats being used for the experiments Ringer's solution (isotonic) distilled water

(hypotonic) and 30 per cent sodium chloride solution (hypertonic) were used. As a result of their observations it was found (1) Intravenous injection of Ringer's solution causes no lasting change in pressure of the cerebrospinal fluid. (2) Hypotonic solution brings about a marked and sustained rise in pressure of the spinal fluid. (3) Hypertonic solution (30 per cent sodium chloride) causes an initial rise in cerebrospinal fluid pressure followed immediately by a marked fall in the pressure below zero.

Following the lead of these experiments on the spinal fluid observations were made by the same authors (9) on the effect of intravenous injections of solutions of different concentrations on the brain with the following results: (1) The brain of animals receiving injections of isotonic solutions is not altered. (2) Intravenous injections of a hypertonic solution (30 per cent sodium chloride) is followed by a marked decrease in the size of the brain. On opening the skull after such injections the brain may be seen to fall away several millimeters from the inner surface of the skull; the brain becomes shrunken; the gyri more rounded and the sulci widened.

From a practical standpoint the introduction of such a solution previous to opening a tense dura in cases of brain tumor will frequently prevent a rupture of the cortex and will also be of signal help in closing a large flap in the presence of intense intracranial pressure.

Thus we are able to apply in the management of these cases the principle of that strange process of nature whereby sap is drawn out of the earth through which the weaker of two solutions passes into the solution through the membrane separating them.

In order that the above experimental findings be of practical clinical value it was necessary to learn whether or not the oral administration of hypertonic solutions would produce the same effect as their intravenous injection. So Foley and Putnam at the suggestion of Cushing undertook the experiments with the following results:

1. Following a massive dose of 180 cubic centimeters of 30 per cent solution of sodium chloride given to a dog by stomach tube the

cerebrospinal fluid pressure immediately fell from 150 millimeters of normal salt to zero.

2. Five minutes after an injection of 35 cubic centimeters of a 10 per cent sodium chloride solution by rectum the pressure began to fall and in 1 hour and 10 minutes had fallen from 112 millimeters to -44 millimeters a drop of 156 millimeters. The blood pressure remained the same.

3. An injection of 5 cubic centimeters of 30 per cent sodium chloride solution in the duodenum produced a fall of 104 millimeters in cerebrospinal fluid pressure. The changes in spinal fluid pressure were accompanied by a decrease in the size of the brain.

With these findings in mind Dowman (2) instituted in the Neurosurgical Clinic of Emory University School of Medicine a hypertonic solution treatment in certain cases of head injuries with brain damage. First he used saturated magnesium sulphate by mouth supplemented by 30 per cent solution of sodium chloride intravenously in certain cases. Later a series of cases was put on enteric coated tablets of sodium chloride.

Though the solution of sodium chloride theoretically offered ideal results there were some drawbacks to be encountered so Temple Fay (4) set about to make a study of the comparative values of magnesium sulphate and sodium chloride for relief of intracranial tension.

An anesthetized dog was used. Two loops of small intestines were tied off by a strong ligature to separate them and their distal ends were ligated 12 inches from the original ligature. Equal quantities of a 30 per cent solution of sodium chloride and 5 per cent solution of magnesium sulphate were introduced into the respective loops of intestine. Within 3 minutes the cerebrospinal pressure began to fall. In 15 minutes the loops of intestines were drained and showed that the magnesium sulphate had drawn 72 cubic centimeters of additional fluid from the animal's circulation while the sodium chloride had drawn only 37 cubic centimeters additional fluid. It was noted that sodium chloride by bowel was often accompanied by discomfort, thirst and nausea and that its effects were transitory and not so complete as those obtained by use of

magnesium sulphate. Also after a certain amount of sodium chloride solution had been used there was a secondary wave of tissue edema with an increase in intracranial pressure. The explanation of the latter lies in the fact that sodium chloride is dialyzable and is rapidly absorbed in the blood stream which in turn becomes hypertonic and extracts fluid from the tissue spaces. Some of the fluid however is taken into the cells and in time this fixed tissue sodium chloride causes the cells to become distended with fluid. In contrast to this magnesium sulphate is non dialyzable and exerts a constant effect on the vascular bed about the intestinal wall withdrawing fluid from the circulation with a secondary withdrawal of ventricular and tissue bound fluids, and an attendant dehydration.

For this reason we have dispensed with the use of sodium chloride except in special indications when quick though transient effects will suffice.

In using magnesium sulphate by way of precaution the possibility of magnesium sulphate poisoning must be kept in mind and care must be taken in acute traumatic cases not to confuse the symptoms of intracranial pressure with those of increased tension plus profound shock.

If as often happens the patient has lost large quantities of blood or has sustained complicating injuries that have brought on profound shock then dehydration is contraindicated as the depletion of an already impoverished and failing circulation will bring about a fatal termination.

In shock the respiration is a result of air hunger will be above the normal rate the temperature below normal and the pulse rapidly rising. While in increased intracranial tension the respiration will be below normal and the temperature rapidly ascending with the pulse.

There is little possibility of magnesium sulphate poisoning as the toxic dose is large and the effects of an antidote are prompt. This has been demonstrated by Weston and Howard (10) in their experiments with magnesium sulphate as a sedative. They showed that in a rabbit that had developed muscular paralysis following a toxic dose of magnesium

sulphate the paralysis disappeared following an intravenous injection of calcium chloride.

Based on animal experiments the fatal dose of magnesium sulphate in a man weighing 75 kilograms (165 pounds) would approximate 120 grams (4 ounces) given hypodermatically.

Although up to the present writing no cases of such poisoning have been encountered in our experience the following picture has been observed in children by Anderson (1). Along with clear mentality there is marked depression signs of respiratory failure slowing and weakening of the heart action motor weakness of the extremities but rarely convulsions. With this general picture there is abdominal pain nausea vomiting rigidity of the abdominal muscles suppression of urine with high specific gravity anuria and usually constipation.

The treatment of magnesium sulphate poisoning consists of elimination by the gastrointestinal tract saline infusions stimulation and hypodermic injections of dilute solutions of calcium salts. (Impulses of 25 grains of calcium chloride for intravenous administration are put up by several reputable drug manufacturers.)

In our series of cases of head injury we have adhered throughout to the classification as outlined by Downman (2).

The classification and the respective indications as to treatment are as follows:

**Class A** Massive brain injury with evidence of rapid exhaustion of the medullary centers and death within one to several hours after admission.

**Treatment** These cases are hopeless and operation is contraindicated.

**Class B** Definite evidence of middle meningeal hemorrhage. As immediate operative interference is imperative one must keep a clear mental picture of the cardinal symptoms which are as follows:

1. A free interval of consciousness often of short duration. In children several days of consciousness may elapse before pressure symptoms develop. On this account children should be kept under the closest observation for several days when the type of injury would lead one to suspect the possibility of extradural hemorrhage.

2 A slow bounding pulse following a slightly rapid and small pulse

3 Stertorous respiration is contrasted with the superficial respiration of cerebral concussion

4 The gradual development of hemiplegia or contralateral convulsions

**Treatment** The operation of ligation of the bleeding artery with subtemporal decompression must be done and done quickly

**Class C** Simple or compound depressed fracture with localized brain contusion with or without indriven bone fragments

**Treatment** Debridement is indicated. Contused brain and blood clots are carefully removed by catheter suction. The dural opening is accurately closed if possible and the bone defect is partially filled by replacing the fragments of bone that have been removed

**Class D** Classic manifestations of rapidly increasing intracranial pressure which are well within the period of medullary compensation

**Treatment** Though these cases are in a measure borderline ones and though many would possibly recover without operation it is our experience that subtemporal decompression with or without a rubber wick drain under the temporal lobe offers the best chance of recovery

**Class E** Definite evidence of brain injury exhibiting no classic findings of acutely increasing intracranial pressure yet of the type that experience has shown is liable to develop gradually increased intracranial pressure due to fluid accumulation

**Treatment** This is the large class of cases previously referred to in which the hypertonic solutions are used with great success. It is the same class of cases as those referred to by Naffziger (7). Though he states that this group is of considerable importance and has attracted no attention we find that Dowman in December 1922 described the same condition and offered the same explanation as to how this subdural but extra arachnoid fluid accumulation has been brought about. In the large majority of this group it will suffice to give one half ounce of a saturated solution of magnesium sulphate every 2 hours for 48 hours (smaller doses in proportion for children). After this the interval of doses is lengthened

day by day as the patient improves until the seventh to tenth day when the hypertonic treatment is discontinued. If despite the oral administration of magnesium sulphate there should develop any evidence of increased intracranial pressure such as bilateral choking stertorous breathing etc. this treatment may be supplemented by one intravenous injection of 50 cubic centimeters of a 30 per cent sodium chloride solution for quick effect followed by intravenous injection of 10 cubic centimeters solution of magnesium sulphate. If as in a few cases the pressure symptoms continue and especially a hemiparesis develops then a subtemporal decompression with rubber wick drainage may be resorted to as suggested by Naffziger. The hypertonic treatment in this class of cases is given with the idea of preventing late pressure symptoms caused by fluid accumulation and there by doing away with the necessity of late operations for pressure symptoms

**Class F** So called concussion with no evidence of gross brain damage. After a few hours these patients are mentally clear and there are no gross neurological findings

**Treatment** Physiological rest and free purgation suffices

**Class G** Depressed fracture of a mild degree giving rise to no symptoms whatsoever

**Treatment** Though many of these patients appear to be in excellent condition and are free from frank symptoms it will frequently be found that underlying the depression is much contused brain and blood clot a condition that may often result in the development of a brain cyst (3). The fractures should be elevated the dura opened contused brain if present removed by careful catheter suction the dura closed and the bone fragments replaced

**Class H** Scalp lacerations without damage to the underlying structures

**Treatment** Scalp injuries are generally treated too lightly. The edges of these wounds should be trimmed away and the wound carefully closed with fine silk sutures. Unless this is done especially if there is a slight injury to the underlying structures the condition enters immediately into the Class A of cases of brain abscess as outlined by MacLven in



his treatise on *Pyogenic Diseases of the Brain and Spinal Cord* (6)

With this classification and brief outline of indicated treatments in mind I wish to submit the following statistical review

During the past 2 years 125 head injuries have been treated with 103 recoveries and 22 deaths

#### CLASSIFICATION OF THE 125 CASES

Class	Cases	Operative	Deaths
A	20	3	0
B	3	3	0
C	22	21	0
D	1	1	0
E	5	1	1
F	14	0	0
G	12	6	0
H	2	2	0
	<hr/> 125	<hr/> 37	<hr/> 2

Of this entire group as above shown there were 2 deaths 103 patients making excellent recoveries only 5 of these showing residual neurological symptoms at the time of discharge from the hospital

Of the 22 deaths 20 were in Class A (massive brain injury) which are hopeless

The 1 death in Class C should really be placed in Class A. This was a gunshot wound of the skull with extensive contusion of the brain and bloody spinal fluid accompanied by a blood pressure which fell in 1 hour from 165 systolic over 85 diastolic to 120 over 60. The case was complicated by a gunshot wound of the right eye requiring an enucleation the patient living only 2 days after admission

One case in Class E died in 6 days after admission from oedema of the lungs the oedema being the direct cause of the death rather than the head injury. This case occurred early in our experience with hypertonic solutions. Thirty cubic centimeters of a 35 per cent solution of sodium chloride were given every six hours. The lung oedema was in our opinion caused by the too free use of sodium chloride. This impression however came too late to save the patient. Since this

experience the intravenous injection of sodium chloride has not been used in this class of cases

The 125 cases herewith reported were carefully studied from every standpoint before treatment was instituted. In addition to the usual neurological examination the roentgen ray the ophthalmoscope repeated blood pressure readings routine spinal puncture etc were employed in an effort to place each case under the proper class. After being thus classified the type of treatment above outlined was instituted. All cases were apparently so seriously injured as to warrant immediate admission to the hospital. Even those cases classified as concussion and scalp laceration were on admission apparently seriously injured. In view of the fact that there were only 22 deaths in the series and of the recoveries only 5 showed residual neurological manifestations on discharge from the hospital it is felt that the classification and type of treatments herein suggested if rigorously followed should materially lower the usually accepted mortality rate in cases of this nature

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## ABDOMINAL HYSTERECTOMY FOR HYDATIDIFORM MOLE

Pr f ssio f Cl l O t t n F l ty f Med i n M t d

The great importance of this decision is not only in the fact that it is a landmark in the history of the American people, but also in the fact that it is a landmark in the history of the world. It is a landmark in the history of the world because it is a landmark in the history of the world.

Examination of the specimen showed the uterus to be completely filled with the tumor mass and among the parts was a dark blood clot. On the right side the mass was protruded from the uterine wall by a clot which filled third of the cavity and was prolonged below the limit of the uterine cervix. The uterus and adnexa were submitted to histological examination.

So curious a coincidence as polycystic degeneration of the ovaries does not of itself justify

**hysterectomy** The very interesting work of Italian gynecologists has incited us to observe the development of ovarian lesions for some time before practicing radical intervention. Numerous cases of spontaneous and rapid reduction in size of the ovaries after expulsion of the mole minimize the gravity which was attributed to this condition by the writers who first described the association of hydatidiform moles and polycystic ovaries.

The infrequency of the indication for hysterectomy is shown by the scarcity of publications. This is the only case in which I have practiced it in 30 years of gynecologic practice. The subject has been discussed in our gynecologic societies in former years without any mention of hysterectomy although most of our members have seen them in practice. Findley studied a collected series of 500 hydatidiform moles finding 20 abdominal hysterectomies, 2 cesarean sections and 3 vaginal hysterectomies. The percentage of operative interference 5 per cent seems much higher than usual in these cases and is probably due to the fact that only those cases have been published which have been of unusual clinical interest.

We may then affirm that in the evolution of a mole only exceptionally need we resort to hysterectomy. Having decided upon hysterectomy which route should be followed? In view of the good result obtained in this case I am of the opinion that all cases in which the uterus do not reach beyond half the distance from the symphysis to the umbilicus the vaginal route is preferable. In a very lean patient with a large vagina probably the limit could be raised to the umbilicus as advocated 25 years ago by those eminent teachers Peau Segond and Quenu. Obviously the vaginal route is less traumatizing and infection less likely. We should bear in mind that the clots which fill the cervix are far from aseptic.

The capital indication for hysterectomy is without doubt uncontrollable hemorrhage. But as pointed out by Vineberg when the excessive thinning out of the uterine walls make curettage a difficult and dangerous task and when fragments of the mole remain inside which can be extracted only at the cost of greater destruction we should more correctly incline to radical operation. Hysterectomy must also be considered when the length and closure of the cervix as well as resistance to dilatation makes us suspicious of serious difficulty in completing evacuation. Our scruples about the indications for the mutilating operation should also be influenced by the fact that those patients having moles are usually multipara who have fulfilled their social missions.

Should the ovaries be extirpated in all cases? This question cannot be definitely answered. The spontaneous disappearance of cystic degeneration of the ovaries imposes a moment of reflection. If the ovaries appear normal or but little changed and when the patient is young extirpation should not be practiced. On the other hand when the ovarian masses are large and especially when papillary formations are observed outside of the cysts and when ascites is present excision is indicated since a tendency toward malignancy must be presumed.

We should also resort to hysterectomy in the patient whose molar expulsion we have not personally supervised when the uterus remains large and bloody. Such patients are clinically upon the threshold of chorio-epithelioma.

#### CONCLUSION

In conclusion the indications for hysterectomy which we propose and which are illustrated in this case are great multiparity, evident mole, cervix long and closed, uncontrollable hemorrhage and intense acute anemia.

## RECONSTRUCTION OF A LARGE DEFECT IN THE POSTERIOR URETHRA

## REPORT OF A CASE

By E. P. OUVIN, M.D., F.A.C.S., BISMARCK, NORTH DAKOTA

A NEW technique for the reconstruction of a large defect in the deep urethra appeared in medical literature in December 1923 just in time to become of use in the case which is reported. McGowan of Los Angeles<sup>1</sup> described a new method of bridging a wide gap between the two end of a resected posterior urethra by means of the corpus spongiosum. He found that by beginning posteriorly the corpus spongiosum could be freed from its attachments to the corpus cavernosum almost up to the glans and yet receive sufficient blood from the arterial anastomoses near the glans to prevent necrosis. McGowan reported several successful results from this method.

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in th f ld and p i n d his p l s f bly g t the  
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hospital 6 h rs aft r the j ry

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Aft r 6 w ks the p t t lega t p and i n t n  
se me i n male p t f r d m t n th d n t n

the team. Vesical irrigations were practiced from the first to the third day after the injury. The patient left the hospital 18 weeks after the injury.

T o m n th late h e r e t u r n e d t o t h e h o s p i t a l c o m p l a  
 f g r e t d i f f i c u l t y i n p u s g t h e i n e w h i c h c o n t a e i  
 p u s a n d o c c s i n l y b l o o d U r t h r o s c o p e x a m a t i o n  
 s h o e d f l s e p s a g e t h r o g h t h p r o t e A n e t e r n a l u  
 u e t h t m y n o w m a d e a n d t h e b l i d e r n t e r e d i  
 d r a e d t h r o u g h t h e p o t e r i u r e t h A p e r m i n t  
 c a t h t w s c e s f u l l y p l a c e d t h r o u h t h e r e t h a n d i  
 i n t t h b l a d d i n t h p p e r p l a c e I n m k i n g t h e p e r  
 i n e l i n i n a n a b s c s s c a v i t y l o c a t e d p a r t i y w t h i n t h  
 i r t a t w s o p e d a f t e r 3 w e k s w h n t h p e r i n f  
 n h e d s m s f l s i n g t h p s i n g f o n d s n a s  
 a g a i n a u g u r a d d a n d c o n t u e d o n c e r t w e a w e e k  
 f r a m t h s

The patient felt so much improved that he neglected his treatment for a few weeks but on March 2, 1920 he was returned to camp following a gradually decreasing team and an increasing frequency of painful micturition. A mild pyelonephritis developed through which pus and occasionally a few drops of urine escaped. From this condition only a staltly filled bladder but also that the ne passed through the previously noted false prostatic penile X-ray examination showed a small irregular shadow at the base of the bladder. This was (erroneously) thought to be a urinary calculus. He had frequently with in the false passage of the penis. When belief that it was a calculus was strengthened when after a few minutes with a weak solution of acetic acid the X-ray in later examination filled the shadow. A tenderness and redness was present deep through the penis. A few days passing of so much mad him so much better that he remained home for 2 months.

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a ut and mpl te et ti the blade be g d i t ned  
t the mbluc The tender s lli in the pe e m  
a till prese t A s prapuc y tot my w s aga n  
m d t r l th ac te ret ton

Two weeks later, a 7 x 7 urethrotomy was again made in the perineum and at the same time a resection was made of a stricture of the membranous portion of the urethra. The section removed was about 1.5 centimeters long. It was really only a mass of granulation and fibrous tissue within which passed a very small and crooked in presenting the urethra. Since practically the whole membrane of the urethra was now gone, it was necessary to mobilize the bulbous portion sufficiently so that it could be approximated and could be made to approximate the two distal ends of the tube. We waited while the infection subsided and then opened the urethra.

The p t r e c t w i l l d June r the supra  
 pub c l k g s t p p e d u n e s c a p e m e n t e l y t h r o u  
 t h u r a l c t h e r w h i w s l e f t n s i a f t e r t h  
 p e r a t i The p e r n e a l s s b o s e m d t o b e c l s n g  
 J e 8 s o u l u p t 3 p s e d i l y a n d u n a t o w s  
 a l m o s t n m a l T h p a t n t w s s e e n i n t h e o f f i c e n e l y  
 e r y w c k f r 3 m t h s f o r t h e p u r p o s e f h n g s o u d  
 p s e d D u r n n t h t m t h r e r m e d a s m l l p n e l

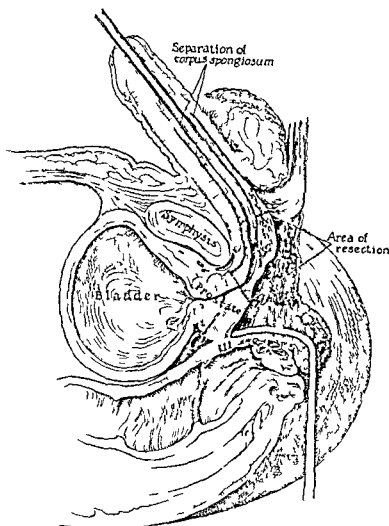


Fig 1. (1) showing the total perineal gland and approximate site of urethral resection and (2) separation of corpus spongiosum.

fistula through which a few drops of pus and urine would escape at micturition.

The patient was seen three times in the year 1902. He could not remember about the same as that just described except that the fistula could be held for a few days at a time and then broke open and discharged in the same manner as before.

In February 1903 he came to the office again. He was complaining of pain in the urethra. The tumor had become much smaller and only very small so no catheter could be passed. The perineal sinus discharged pus constantly but no urine. There was present some pain in the inguinal region.

He felt much discomfort because of his micturition and did not submit to any further treatment until December 1903 when he entered the hospital for

sixth time. The tumor had again had acute retention of urine. The bladder was distended to the umbilicus and on the perineum was a deep sinus discharging profusely. Efforts at catheterization were futile. The sinus was not enlarged but could be made to enter the bladder. It was therefore recommended that a suprapubic opening through the old scar. Roentgenograms made at this time showed again the same had which had been noticed March 1900. By means of a probe passed through the perineal sinus deeply into the region of the prostate. The loose hard body could be felt. The sinus was opened sufficiently to admit a small rubber forceps and small bone sequestrum came out by 1 centimeter by a millimeter was removed. The perineal sinus was held up promptly and the preoperative condition of a sore sinus disappeared entirely and for the

first time from the sub-ostatic region. Had it been recognized earlier that a bone fragment separated from the site of pubic fracture had become foreign body and a focus of infection the length of disability might have been much shorter. The treatment greatly simplified.

There remained however a total obstruction to all efforts at finding urethral passage to the bladder. All urine escaped through the suprapubic route. In view of the dense scar tissue throughout the perineum the prospect of a new radical perineal operation seemed anything but inviting. Fortunately the McGowan operation appeared just in time to become of use in this instance. January 24, 1924, the operation was put to a test on our patient.

Sacral anaesthesia was used. A wide dissection was made of the entire perineum. As nearly as possible all scar tissue was removed. This is equivalent to saying that all tissue in the space bounded by the prostate, pubic arch, skin, rectum and inferior pubic rami was excised. Much difficulty was met in saving the rectal mucous membrane because the contracting scar had produced a diverticulum of the rectal wall. The upper end of the urethra was severed well within the prostate capsule. This produced very troublesome bleeding which necessitated hemostatic suturing of prostatic tissue. The distal end of the urethra corresponded to the anterior part of the bulb, the posterior segment being excised because of its distortion from scar tissue. The length of the gap between the two urethral ends when all parts concerned were resting without tension was measured and found to be slightly more than 5.5 centimeters. The incision was now enlarged along the under surface of the penile urethra, the scrotum was split and the testes separated. The corpus spongiosum was dissected free from the urogenital diaphragm from the crura penis and from the overlying corpus cavernosum until a point some distance beyond the middle of the penis was reached. It was then found as McGowan had stated that the corpus spongiosum with the contained urethra easily stretched out and could be anastomosed to the prostatic urethra without tension. Tension was further obviated by the fact that the proximal part of the corpus cavernosum bent upon itself and thereby shortened the distance from prostate to glans. There was free bleeding from the urethral stump showing vascular continuity.

It will not be necessary to detail the steps of the anastomosis. The McGowan technique was

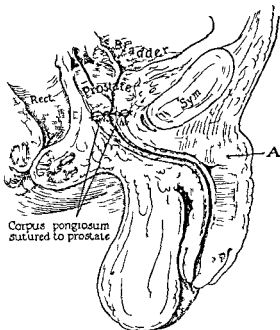


FIGURE 1. Reconstructed urethra. Note bleeding of corpus spongiosum. A.

followed as nearly as possible. It proved to be a very difficult and time consuming operation and required the most delicate instruments obtainable (borrowed from the ophthalmic surgeon). The space around the free urethra was filled with attached fat flaps prepared from the ischio-rectal region. The wound was left partly unsutured. The suprapubic vesical drainage was maintained and a small catheter left in the urethra.

The postoperative history was surprisingly smooth. There was a small urinary leakage in the perineum during the second week after operation but at the end of the third week he could pass and control normally and with a full stream the solution irrigated into the bladder. Sound were passed once or twice a week for several months. He was seen last in June 1925, 17 months after operation at which time his urination was practically normal.

Tentative evidence of returning potency absent since the injury in July 1919 added a much needed psychic relief.



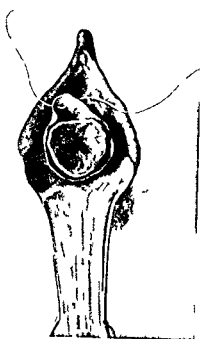


Fig 1 First loop of fistula shown in position of the fistula on the vaginal surface of the fistula edge

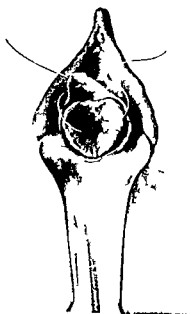


Fig 2 The fistula complete before being drawn out

t n ecessitated peatedma pul tin irng ton ith draw l nd rei se ion of the th ter ta ing t th l m t ot o ly th v il ce nd ing n ty f the attend nts but th t lera c of the p nt bladre

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On th t r v the repe t d d a ly ma p latu ns and re dju me ts neces tat d by its recurring b tract n and ts dem st ted fal r to drain adequately e e when n bstru ted n i ed m th t ts pres ce th s pa tent s bl dd co tit ted a pos ti ely d trum nt telem nt th ft tr tm nt f th case

Balancing the theoretical considerations discussed at the beginning of this article in the light of my previous experience I have found the inference obvious that in successful cases the indwelling catheter is unnecessary and when apparently necessary i u less

Thus resolved to omit this time honored sin of commission I operated for the second time October 14 1924 adopting the following procedure which is practically an extension of the tracheloplastic method published on a previous occasion

The cervical stump was fixed by two small bullet forceps one grasping its anterior the other its posterior lip

A circular incision skirting the lowest edge of the cervical margin penetrated the thickness of its vaginal mucosa Through this incision the entire vaginal sheath of the cervix was liberated from the underlying cervical musculature as a cylindrical cuff up to the vaginal dome the dissecting scissors in their upward path cleaving the vesical from the vaginal layer of the fistula



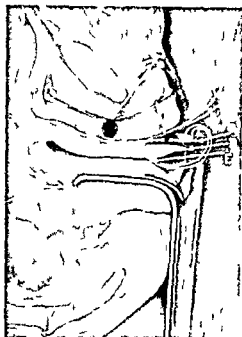


Fig 3 Schematic of the suture course for the anterior flap. A Vesical gland, B Vaginal gland, C Vaginal mucosa, D Marginal fold of cervix, E Suture. The diagram shows the suture course for the anterior flap, with the suture passing through the vaginal wall and the cervical canal, and the suture being tied to the internal os.

The cylindrical cuff of vaginal mucosa thus liberated was split upward bilaterally for a distance sufficient to yield an ample anterior and posterior flap. The anterior flap was dissected completely from the underlying bladder to the base of the urethra while the vesico-uterine attachment was severed to the peritoneal reflection. The resulting mobilization of the bladder permitted a ready approximation of the fistulous gap in the vesical wall without undue tension. The entire diseased endocervical mucosa was then excised and a raw muscular funnel was left with its apex at the internal os.

The objective in the next step was to slide the anterior vaginal flap over and beyond the fistulous area into the denuded cervical cavity up to the internal os and retain it there by suture thus substituting a dam of intact vaginal mucosa for the perforated ectocervical tissue at the original site of the fistulous defect and by the same means avoid the unfavorable direct superposition of hysterectomies.

This sutural coaptation of the flap was accomplished in a manner identical with that employed

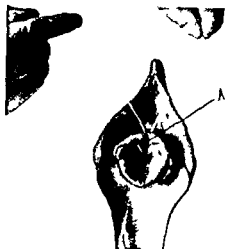


Fig 4 Tract on the end draw the flap into the lococervical cavity through the internal os. The diagram shows the technique for drawing the flap into the lococervical cavity, with the suture being used to draw the flap into the cavity.

in the tracheloplastic method referred to above and detailed here for those unfamiliar with its technique.

Beginning with the anterior flap a long strand of heavy silkworm gut threaded in a round needle is passed on the vaginal surface transversely through the free border of its central tip  $\frac{1}{8}$  inch from the edge like the first loop of a mattress suture the entrance and exit of the strand entering about  $\frac{1}{8}$  inch of tissue (Fig 1).

The right free end of this strand is carried into the cervical cavity to a point just above the internal os where piercing the cervical musculature in a direction forward slightly upward and to the right it emerges on the anterior vaginal fornix at the base of the flap. The left free end of the strand after being carried to the same point within the cervical cavity just above the internal os is passed in the same manner forward slightly upward and to the left so that the two free ends diverging lightly in their transit reappear on the anterior vaginal fornix about  $\frac{1}{8}$  inch apart where they are left to hang loose for the time (Fig 2).

The suture course for the posterior flap runs parallel to the above but in a posterior direction the free end of the silkworm gut emerging on the surface of the posterior vaginal fornix.

By tightening and tying each individual set of suture end the vaginal flaps are drawn into the denuded endocervical funnel to the internal os where they are held in close apposition until union is assured about 3 weeks (Fig 3).

For greater facility and control in directing the transcervical course of the suture a specially modified Peaselee needle should be substituted for the round needle after engaging the first loop of the suture at the free margin of the flap (Fig 4)

In sliding the anterior vaginal flap to its anchor age within the cervix the site of its fistulous perforation was transposed from the original position over the bladder defect to the margin of the external os over the solid cervical musculature. A few supplementary catgut stitches uniting the trimmed lateral edges of the flaps brought the operation to a close.

The comparative ease and facility of each step in this procedure presented a striking contrast to the difficulties encountered with the Mackenrodt method under identical conditions in the same patient.

As already stated the customary postoperative bladder drainage by an indwelling catheter was purposely omitted. The patient was to be catheterized only when spontaneous urination was delayed beyond 4 hours. The necessity arose twice during the first 12 hours following the operation. From that time throughout the entire period of the uneventful convalescence to her discharge from the hospital on the fourteenth day she voided normally at intervals of from 4 to 6 hours. Three weeks from the date of her last operation I removed the silk worm stitches and found the flap firmly united throughout its entire extent.

Under the date of December 6, 1924, she writes:

In answer to your letter of inquiry I am glad to state that there is no leak. I pass my urine

normally every 4 or 5 hours during the day and do not have to rise for this purpose at night.

In an epicritical retrospect of the procedure adopted in this case I must confess to some vague preliminary misgivings as to the possible outcome of my departure from standardized method, but a rather extensive experience with tracheloplasty has tended to convince me that the flap would hold and I reasoned that if the flap held in its position the urine can not possibly leak through.

The wide area of coaptation in this union fortified by the angular approximation of the flap in curving from its base to its point of fixation within the cervical cavity at the internal os offered a degree of resistance to urinary escape sufficient to make it reasonably certain that even in the eventual breakdown of the bladder suture from intravesical infection this resisting flap would dam any possible urinary leak into the line of least resistance, namely, back into the bladder, thus resulting at the worst in an occult, symptomless *vesicoesical* fistula in place of the distressing *vesicovaginal* fistula.

The proximity of the original fistulous site to the cervix rendered this procedure feasible and I would unhesitatingly adopt it again in any similarly situated fistula.

The marked contrast in the convalescent course of this case with and without continuous bladder drainage has convinced me that the traditional indwelling catheter in the cure of vesicovaginal fistula is a sanctified relic from the thralldom of antiquated dogma that should be consigned to the limbo of the obsolete.

## CONICAL RESECTION OF THE UTERUS WITH ABDOMINAL FIXATION

By JAMES N. JACKSON, A.M., M.D., F.A.C.S., KANSAS CITY, MISSOURI

THE technique herewith presented has been used in our work for a period of 10 years. The results in selected cases have been more satisfactory than those offered by any other method with which we are familiar. The experience has been sufficiently extensive and the time test long enough to justify our presentation here.

## INDICATIONS

The general indication for this method is found in cases of rather marked relaxation and insufficiency of the pelvic fasciæ and the uterine supports. This condition may be either (1) primary and due to developmental defects in which instance we find usually only a retroversion with pelvic relaxation or it may be (2) secondary, a sequence of child bearing with its stretching of supports and is then often accompanied by (3) perineal and vaginal relaxation and tears and usually ends in a more or less complete prolapsus. These cases obviously require support from above either with or without repair work below. When the abdomen is opened to effect this support it

will be found in certain cases that when the uterus is drawn up sufficiently to take out the slack in the pelvic supports the fundus and perhaps most of the uterus presents entirely outside of the abdominal wall. It is obvious that if this fundus is dropped to the level it would occupy either in an ordinary round ligament operation or in the usual abdominal suspension or fixation operation the pelvic relaxation will be only slightly if at all improved. Furthermore in many cases the uterus is large and heavy and will produce a rather marked strain on any such support.

In such cases one has perhaps resorted to a supravaginal hysterectomy with fixation of the stump to the abdominal wall. If this is done it is usually necessary to remove the ovaries for if they are conerved their circulation is impaired by the ligatures necessary in the hysterectomy and the chances are that consequent cystic degeneration will follow and a secondary operation be necessary. In case of prolapse which is usually found in women at or beyond the menopause the

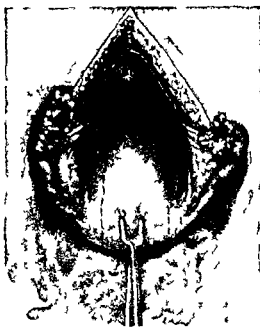


Fig. 1. Inc.



Fig. 2. The peritoneum closed around the uterus and the suturing of the uterine fundus to the abdominal wall.

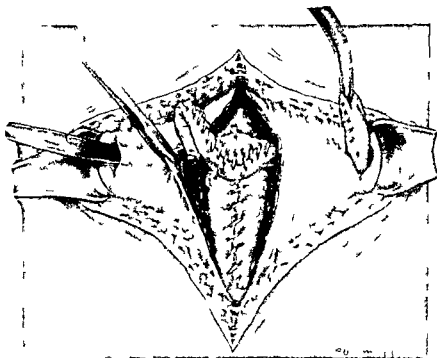


Fig 3. An undraining suture has been made on either side of the rectum and a puncture made about 1 inch out of the median incision.

removal of the ovaries involves no objection if that were the only point. In the other types of cases however the patients are usually younger women and we desire to conserve their ovaries. In many instances these patients have had perhaps one or more children as many as their physical condition permits them properly to care for so that in our judgment they should be sterilized but not by ovarian sacrifice.

Our experience with abdominal fixation of the stump of the amputated uterus has not been very satisfactory. After all it is only a contact or adhesion support and likely to loosen up or stretch with recurrence of troubles. I believe therefore that we have the groundwork for a class of cases in which something different is indicated.

We shall make no claim to originality in the principles involved in the technique we advocate. The first time we saw an operation which involved conical resection of the uterus with abdominal fixation the late John B. Murphy performed the operation. After conical resection of the body of the uterus he simply everted the raw lateral flaps of uterus and fastened them up against the under surface of the abdominal wall. In attempting to follow this operation we found several defects.

1 The fixation was after all but a contact or adhesion fixation.

2 The raw flat surfaces were likely to give a long continued and troublesome oozing of blood with an ensuing hematoma unless drained.

3 The open cut cervix often led to a persistent fistula especially when drainage was used often opening secondarily where there had been no drainage.

To correct these defects the present operation was evolved. Possibly the problem has been solved likewise by others.

#### TECHNIQUE

The abdomen is opened by the usual mid line suprapubic incision. If there is no other intra-abdominal complication a fairly short incision is sufficient. The fundus is grasped with a double vol ellum and drawn up. As we remarked before in cases in which this operation is particularly indicated the uterus presents well above the abdominal wall. The peritoneum is closed around the uterus the cervix being caught just above the bladder reflection in front and likewise low down on the cervix behind. The suture is carried on to complete closure of the entire peritoneal incision. The peritoneal cavity is thus opened only momentarily.

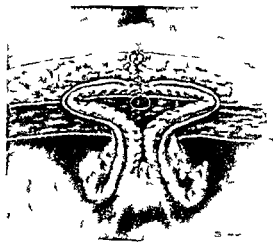


Fig 4 Ovarian plect

larly and the remaining work is completed extra peritoneally. The tubes and ovaries are just below the peritoneal suture. We usually now grasp each cornu of uterus with other volsella to hold the organ taut. A conical resection of the body of the uterus is now made well down to the cervix in front and behind the cutting being done entirely outside the mucosa until the canal is divided at the lowest level. In making this excision the cut is bevelled. The bleeding is remarkably slight. A few vessels on the cut surface may require ligation. A suture ligature which does not slip is best. A few mattress sutures may be used across the bottom of the bevelled flaps to control bleeding further and to approximate the lower portion of the groove. The anterior and posterior edges of the uterine flaps are now sutured together

from cornu to cornu usually with an interlocking suture to further suppress oozing. We now have two finger like round ligaments on each side with the cervical canal entirely closed over. Before this suturing the mucosal canal is sterilized either with carbolic acid or better with the actual cautery tip. An undermining incision just above the rectus fascia is made on either side and a puncture is made through fascia and muscle about 1 inch outside the median incision. This puncture is made large enough to permit delivery of the tongue like flaps without strangulation. The delivery of the flaps is usually made with a small double tenaculum passed from without inward the tip of the ligament (if I may so call it) being grasped and pulled through to the top as in a round ligament operation. The remainder of our original abdominal incision is now closed in the usual manner. The two uterine flaps are brought over and sutured together in the mid line and to the rectus fascia. The uterus is thus held up firmly as by ice tongs and cannot get loose. The skin incision is closed as usual with a small drainage of rubber dam to provide for possible oozing.

This operation brings the cervix up to the level of the abdominal wall and effectively takes out the pelvic slack. It is well to remember that the flaps above the fascia will present a small continuous mass which might be mistaken for a hernia by a patient inclined to be uneasy. This can be prevented by proper explanation. The uterine and ovarian vessels are not ligated and the ovaries are left with a normal circulation. The patient is sterilized. Occasionally for short periods of time there may be a slight menstrual flow of blood from the mucosa of the cervical canal unless this is destroyed by cautery. This possibility should likewise be explained.

# DISLOCATION OF THE SHOULDER OF SIXTEEN YEARS STANDING REDUCED BY SUBPERIOSTEAL OPERATION

By ROLAND MEISENBACH M.D. BUFFALO NEW YORK

THE case reported is of significance for several reasons namely because of the longstanding condition and the change in anatomical contour of the parts involved

The patient a strong healthy lad of 6 years gave the history of having had a dislocation of his right shoulder since birth. Whether the dislocation was postnatal or not could not be ascertained. However the affected arm was short rather than the other by many inches and this shortening temporarily increased as pressure was borne against the arm in olden times. Limitation in motion in all directions was noted and the patient complained of weakness and lack of stability in his right arm therefore he was handicapped in attempting to move any object of considerable weight.

The freedom of motion with which the head of the humerus had during the 6 years of dislocation from the glenoid cavity caused it to grow in an irregular shape. It almost square. Although the humerus was out of the socket and dislocated posteriorly the arm could be used in certain directions but any pressure of the hand toward the body would cause the humerus to bulge posteriorly and bother the spinous process of the scapula. This bulging was so pronounced that it was so prominent to the eye in the arm of a lump about the size of a small egg. It could be seen through the clothing. The free movement of the head in all directions was impeded by the capsular adhesion. Every time the thickening of the capsule in its position grew. At the present time the capsule was so thick that it beat against the front of an inch thick and very redundant throughout its position.

On the other hand the glenoid cavity through lack of function grew to a lesser degree than the surrounding structure and was somewhat flattened and small than normal. From the roentgenograms both these anatomical changes made it almost every evident that the impaction procedure could not be used to reduce the dislocation because mechanically the head was so large that it could not be forced back into the glenoid cavity.

This case had been seen by several surgeons who very correctly suggested that it could not be reduced because of the enlarged square head. However upon close examination of the roentgenogram it was noted that the acromioclavicular and coracoclavicular processes did not droop very much. If they had drooped it would have been the indication of any surgical procedure impossible.

As has been said above the head of the humerus was markedly square and thus gave the opportunity of considering an operative procedure by which the head could be made similar to a distal retaining the normal muscle attachments as before at the same time without interfering with the piphyses.

**Subperiosteal operation** A curved incision about 15 centimeters long was made on the posterior right shoulder joint extending from the tip of the acromion process across to the tip of the superior angle of the scapula down to the capsule. It was found that the capsule was very redundant so that when the arm was pushed backward there was considerable play which allowed the capsule



Fig. 1. The position of the humerus before operation. Note the dislocation. The shoulder is also relatively glenoid cavity.



Fig. 2. Shoulder replaced in glenoid cavity. Note rounded head of humerus in position. The glenoid cavity which allowed full range of motion.

with the head encased to bulge through the incision so that when the arm was moved in any direction much play was afforded and at the same time the humerus was suspended by the capsule much as in a case of congenital dislocation of the hip joint

Incision through the capsule showed its thickness to be more than a quarter of an inch over the region of the head. The capsule was drawn across the glenoid cavity and was slightly adherent but not as much as one would suppose.

After the head had been exposed through the opening in the capsule with a very sharp carpenter's gouge the periosteum of the humerus was nicked all the way around about 1 centimeter below the epiphyseal line of the humerus. At the division of the periosteum and at four points corresponding to the corners of the square head of the humerus the bone was engaged with the gouge and with firm and decisive taps of the mallet a subperiosteal osteotomy was done to remove the sharp corners of the head at the same time without disturbing any of the soft structures around the joint. The periosteum was then sewed down. By this procedure the size of the head was materially reduced and rounded and after the adherent capsule had been loosened with a blunt dissector the head was easily replaced in the glenoid cavity.

Now that the head had been replaced in the glenoid cavity the problem arose of holding it so that

any backward pressure of the arm would not dislocate it.

The enlarged redundant and thickened capsule was made use of by reefing it in such a manner that it closely surrounded the newly formed head and by anchoring both ends of the reef one in the neighborhood of the coracoid and the other to the acromion process. As the head was forced into the glenoid cavity it snapped back in position as if it had been in place for the previous 16 years. The incision was closed. Convalescence was uneventful.

#### RESULTS

The lad has been working for an express company for several years and is now able to push a trunk with both arms with greater strength and has motions in all directions especially in circumduction which formerly had been limited. The success of the operation depended upon the mechanical judgment as much as the surgical technique. It must be borne in mind that to obtain results in this type of operation the crux of the whole thing is not to disturb any of the muscular or ligamentous attachments. In this operation the entire procedure of remodeling the head of the humerus was done subperiosteally with the exception of the original incision and the incision through the capsule. Although a few bone chips remained they resorbed themselves in new positions so that they did not interfere in the least.

## CONTROL OF ACCIDENTAL HÆMORRHAGE FROM THE CYSTIC ARTERY

By DUNCAN PARHAM M.D. TITUSVILLE PENNSYLVANIA

IN the course of an operation for the removal of the gall bladder it occasionally happens that the cystic artery bleeds either from the failure to catch the vessel on account of its anomalous course or from the slipping of a ligature insecurely tied. A pool of blood quickly forms rapid sponging may perhaps show dimly the location of the hæmorrhage but the glimpse of the bleeding vessel is so momentary that it is with the greatest difficulty identified and caught.

Such an accident may result not only in a severe loss of blood but also in injury to the bile ducts the portal vein or even the hepatic artery. Quick and excited efforts to grasp the bleeding point through a welling field of blood are unsatisfactory and dangerous. At this point a very risky thing is sometimes done. The attempt is made to put a suture through the mass of tissue from which the blood seems to come. Sometimes this is successful but it may happen that the portal vein is punctured or the common duct included in the ligature.

The following technique is proposed as an effective method of controlling this hæmorrhage so that the artery can be carefully and safely caught. The principle is to control the cystic artery by compression of the hepatic artery. This is done by placing a finger through the foramen of Winslow if patent and the thumb over the vessels running in the hepatoduodenal ligament. If the foramen of Winslow is obliterated by adhesions the hepatoduodenal ligament may be grasped en masse between the fingers or the

vessels may be compressed backward and mesially against the vertebral column. If the hand occupies too much room the incision can easily be enlarged while the hepatic artery is being compressed. If the gall bladder is already stripped from its bed the field of operation may be mopped dry and kept dry if gauze is held in the oozing bed. Now by momentarily relaxing pressure on the hepatic artery a spurt of blood will proceed from the cut end of the cystic artery. The exact location of the bleeding point can be made out by this several times repeated and forceps placed precisely on the tip of the vessel which is then easily ligated. Abnormalities of the cystic artery will not militate against success as in all cases it must arise from the hepatic artery or its right terminal branch or run through the hepatoduodenal ligament.

I have not found occasion to employ this method on a human patient nor have I seen it used. A search of the literature reveals no suggestion of such a procedure. However in repeated experiments on dogs during the past year it has been uniformly successful twice when ordinary methods were apparently going to result in failure.

It may be added that in case of postoperative hæmorrhage the cystic artery may be proved culpable or innocent by compressing the hepatic artery. If hæmorrhage ceases the cystic artery should be found and caught if hæmorrhage continues the bleeding point must be sought for elsewhere.



## EDITORIALS

### SURGERY, GYNECOLOGY AND OBSTETRICS

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SEPTEMBER 1925

#### POSTGRADUATE MEDICAL EXTENSION TEACHING

THAT extension teaching in medicine for the benefit of the busy general practitioner is practical and gratefully received is clearly demonstrated in reports presented from Pennsylvania and North Carolina at the last annual conference on Medical Education, Medical Licensure, Public Health and Hospitals. These reports merit careful study. They set forth an idea which is not entirely new, although it has been accorded little general attention in the past.

Probably Wisconsin deserves the credit of being the first state in which a systematic endeavor has been made to maintain a formal teaching program in the home environment of the family doctor. The University of Wisconsin inaugurated its work in 1914. Other states include Georgia, Indiana, Iowa, Massachusetts, Michigan, Ohio, Vermont, and West Virginia. The highest development has been reached in Pennsylvania, where teaching centers have been established in half a dozen or more accessible points and clinical instruction is conducted by the senior members of the faculty of the Graduate School of Medicine of the University of Pennsylvania.

This being a comparatively untrodden field in medical education, the effort has of necessity been largely experimental. Quite naturally, therefore, the procedure has varied in different states. In some the state medical society has initiated the movement. In others a university has been the sponsor. Regardless, however, of the responsible body, the objective has remained the same—practical instruction for the busy practitioner.

Therein lies the gist of the matter. The teaching must be adapted to a particular group of men and their need, their daily activities and their limitations must ever be in the mind of the professor. So often medical education has for its object a change of status on the part of the student that it requires a special effort to realize that in this instance no such change of status is contemplated. As a general practitioner the student embarks upon his course and as a general practitioner he concludes his studies, but richer and more capable by virtue of the review and inspiration that he has experienced.

These students are from the great group who have devoted their lives to a homely service for mankind, who often carry out their work without the advantage of hospital environment, who must forego the refinements of laboratory diagnosis, who depend less on great technical ability than on a keen insight into human psychology. Eye, ear, and fingers are more to them than microscope, X-ray, or electrocardiograph. Elaborate apparatus is of academic rather than practical interest for they cannot install it in their offices nor carry it from house to house in the course of their lengthy rounds. Yet these men are the first

line of the Nation's defense against disease for they are the ones to whom the vast majority of patients turn directly in event of sickness or injury. With little time to devote to reading too busy to seek the university centers for formal instruction very many of them must forego the stimulus of graduate study unless extension teaching centers are established in their own localities and the university thus brought to them. The wise teacher will temper his presentation to their needs.

Surveying the work so far undertaken in this country it is apparent that the efforts of the universities have been characterized by a greater impetus and a wider scope in the teaching. One could hardly imagine a more comprehensive program than that inaugurated in 1922 by the University of Pennsylvania. It may well be taken as the ideal to ward which to strive. The universities and their faculties of experienced teachers cannot be ignored. They must have a place in this scheme of medical education. However there is no university in the country which is able to reach from coast to coast. It is doubtful if every one of the 79 medical schools is in a position to undertake extension teaching. The allocation of the country among willing universities is hardly practical. If therefore extension teaching is to become widespread some organization of nation-wide scope must assume the burden.

There are several such organizations already in existence. The American Medical Association. The American College of Surgeons. The American College of Physicians. There are also the great foundations any one of which might well find in such activity a dignified and useful field of labor.

It is earnestly to be hoped that some powerful organization will undertake thoughtfully and conscientiously to sponsor this program for the benefit of the general practitioner. For

whosoever will directly benefit him will also through him benefit the whole nation.

ETHAN FLAGG BUTLER

## HYPERIMMUNITY PRODUCED BY SURGERY

EVERYONE is born with a certain degree of immunity against disease.

If there were no immunity whatever at birth the child would probably succumb to the inhalation of air for air contains various pathological microorganisms which would find very suitable soil in an unprotected individual. Besides this natural immunity each individual gradually acquires during life an additional immunity. This immunity varies with different infections and gradually diminishes. In some diseases such as mumps it remains permanent in others such as smallpox it lasts for years while in still other diseases such as measles diphtheria and scarlet fever the immunity lasts a shorter period of time.

The body may also be immunized artificially by vaccines or serums a method well known to us all. Thus we have three methods of immunization (a) the natural (b) the acquired and (c) the artificial.

Immunization may be produced with an infectious disease the degree of which may be so slight the patient may not even be aware of any real illness. A repetition of such slight attacks of infection will gradually produce immunization. This gradual acquisition of an immunity by the patient is his greatest asset in the battle against reinfection by the same disease.

Efforts to cure a patient with an infectious disease are made in two directions (1) by reducing or checking the disease and (2) by increasing the resistance of the patient.

Unfortunately it is sometimes impossible to check the progress of the disease. The microorganisms may have invaded the body in such

large masses and with such force and intensity that the patient is unable to cope with them and in spite of all efforts on the part of the physician the patient's health declines.

The immunity however may be increased in various ways. For instance by vaccines, fresh air, increased nourishment, hydrotherapy and medications. This increase of immunity may at times furnish that small margin necessary to overbalance the degree of the disease and in this way spontaneous cures may take place. Very often such cures are credited to psychic influences or to the treatment by charlatans or various cults such as Christian Science.

When the human body does not respond to any of these aids the problem becomes a very serious one. This lack of response to immunization on the part of the human organism may be due to one of two causes: lack of virility or a faulty mechanism in the formation of antibodies or to both. Medical treatment thus becomes ineffective.

In such a dilemma we must look to other sources for help. May not surgery help us in such a situation by increasing the resisting power or immunity of the patient? Surgery cannot increase the immunity of the patient but it can, by the removal of a large part of the diseased tissues, decrease the volume of the disease and reduce the toxic products without decreasing in any material way the immunizing substances which the body has acquired. For instance, after the removal of tuberculous tubes in tuberculous peritonitis or the removal of a tuberculous kidney, the patient usually gains very rapidly. And when foci of the same disease exist in other parts of the body, such as a co-existing tuberculous bladder, the latter will heal spontaneously after the kidney has been removed.

In previous discussions I have illustrated this principle of *disease versus immunity* by a

debit and credit ledger account showing on the credit side the amount of immunity and on the debit side the amount of disease. A surgical procedure may easily reverse the balance in favor of the credit side sufficiently to produce a cure.

Let us illustrate this principle of 'hyper immunity' with a hypothetical case. A patient afflicted with extensive tuberculosis of his right kidney and a slight affection of his left kidney and bladder has at the same time scattered foci of tuberculosis in the lung and in other parts of the body. This patient has as the disease progressed developed a certain degree of immunity against all foci of the disease, the total immunity however is not sufficient to overcome the disease. In other words, the immunization has not kept pace with the progress of the disease. To make this clearer, let us improvise figures to represent the degree of the disease and the degree of immunity and take an inventory of his present condition. In the table below we represent his status in the form of a debit and credit account, placing the units of disease on the debit side and the amount of immunity on the credit side. (See table.)

IMMUNITY BALANCE TABLE

	Debit (-on us)		Credit (to us)
Disease		Immunity	
Right kidney	2	Immunity	5
Left kidney	4	Immunity	15
Bladder	5	Immunity	2
Lung	8	Immunity	3
Glands	6	Immunity	6
Scattered	6	Immunity	4
	49		39
Right kidney removed	20		
Total	29		
Residual immunity			

The foregoing table shows that the total of the units of disease is 49 and of the immunity only 39. Thus the patient is lacking at least 10 units of immunizing substances to bal-

ance the units of the disease. But he should have more. He should have a surplus of immunity in order to eliminate the disease. How can this increase be effected in this case? By judicious surgery!

Unable to increase the immune substances surgery reduces the total of disease. In this instance we remove the largest focus—the diseased right kidney—which represents twenty units. By doing this we change the balance in his account. He will then have the 39 units of immunity with only 29 units of disease and a surplus of 10 units of immunity. The body is thus brought into a state of hyperimmunity—a condition most favorable for recuperation.

The figures in my table are improvised merely to illustrate the relative status between

disease and resistance because as yet we have no scientific measurements of immunity. Efforts in this field are being made at present by P. Lecomte Du Nouy at the Rockefeller Institute. They will not seem so theoretical however when considered with what actually happens in a given case.

A retrospection into the histories of some of our past cases will prove to us the truth of this. We will recall cases when for instance an amputation of a chronic suppurative limb produced a spontaneous healing of suppuration in other parts of the body; cases in which the removal of tuberculous tubes produced a complete healing of extensive tuberculous peritonitis etc. May not this principle be employed more widely if we keep it constantly in our minds?

EMIL G. BECK

# MASTER SURGEONS OF AMERICA

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## HENRY HODGEN MUDD

**H**ENRY HODGEN MUDD eldest son of Henry Thomas and Sarah Elizabeth (Hodgen) Mudd was born in Pittsfield Illinois April 27 1844 The earliest record shows that in the fifteenth century some members of the family were forced by religious or political persecution to leave Poland and seek refuge in Wales The history of the family in America goes back to 1634 when three brothers emigrated from Wales to this country coming over in the service of Lord Baltimore governor general of Maryland It is from one of these brothers that Dr Mudd traces his descent

In 1856 Dr Mudd then a lad of 11 came with the family from Pittsfield to St Louis where he spent the remainder of his life Educated in her public schools and the Washington University and pre eminent in her medical circles for many years St Louis may justly claim him as one of her distinguished sons

He received his medical degree from the St Louis Medical College in 1866 and was immediately appointed interne in the St Louis City Hospital where he remained a year In 1867-68 he served as acting assistant surgeon with the 13th U S Infantry stationed in Montana Returning to St Louis he began civil practice with his uncle Dr John T Hodgen January 1 1869

It was inevitable from his connection with so distinguished a surgeon as Dr Hodgen that his practice should become more and more surgical and finally be limited to surgery Success in this field brought him a large practice and a reputation that acclaimed him the leading surgeon of his city and state and made him nationally known

A skillful operator careful and conscientious in his work he possessed unusual surgical judgment the result of constant study and the knowledge gained by experience Rationally conservative he was not restrained by timidity or indecision from carrying out whatever measures however radical his judgment approved He could be bold but never reckless and he met every emergency with coolness In his relations with his patients honesty and disinterestedness were outstanding characteristics of the man and won for him their confidence and esteem Able surgeon that he was and exceptional as were his achievement in that line his most important work undoubtedly was done in the field of medical education



HENRY HODGEN MUDD  
1844-1899



For nearly the whole of his professional life he was connected with the St. Louis Medical College: a preceptor and demonstrator of anatomy from 1842 to 1853; professor of anatomy from 1853 to 1883; professor of anatomy and clinical surgery from 1883 to 1886; professor of surgical anatomy and clinical surgery from 1886 to 1890; and professor of clinical surgery and dean of the faculty in 1890. His service as teacher and executive was terminated only by his death November 10, 1899.

A teacher his constant aim was to make his instruction practical and helpful to his student and he sought to improve them by the clearness of his presentation rather than by erudite diction or elaborate oratory. His lectures therefore were simple, logical and full of useful suggestions. He was quick to recognize merit in his students and his quiet smile of approval or occasional word of commendation was valued more by them than would have been effusive praise from other. His influence on them was not confined to the class room for from his character and example they gained an incentive to uprightness and high ideal which must have had a lasting, if unconsciously effected upon their later lives.

As dean of the medical school his unusual administrative ability and his far-sighted policy made him a powerful factor in the advancement of medical education in the Middle West. It was a time of transition and of increasing demands upon the resources of independent medical schools and he fully realized the necessity of a university connection for them if they were completely to fulfill their obligations. It was in the second year of his deanship that the St. Louis Medical College became the Medical Department of Washington University, a union destined to develop one of the great medical schools of the country.

Dr. Mudd was for many years surgeon in chief of St. Luke's Hospital and through his ability and reputation contributed very largely to its growth and prestige. He took an active part in the work of the St. Louis Medical Society and was its president in 1881. He was also a member of the Medical Fund Society of St. Louis (an organization formed solely for the betterment of medical education), the Missouri State Medical Association, the American Medical Association and the American Surgical Association.

Dr. Mudd's most important published articles are the one on Hernia in *Hood's Reference Handbook of the Medical Sciences*, the one on the Surgery of the Mouth and Tongue in *Dennis System of Surgery* and the chapter on Fractures and Dislocations in *Park's Surgery by American Authors*. Besides these he was the author of many valuable papers read before various medical societies which unfortunately have not been preserved.

He was modest in self-appraisal, undemonstrative and somewhat reserved in manner and his strength of character and the charm of his personality won for him the confidence and affection of all who knew him well.



He was generous and sympathetic and no one who came to him for advice or assistance failed to find in him a wise counselor or ready helper

He spent his life in service to others What higher commendation than this can any man deserve<sup>1</sup>

For when the One Great Scorer comes to write against your name He writes not that you won or lost—but how you played the game

When the light of such a life goes out there lingers long in the minds and hearts of those upon whom its light has fallen an afterglow of pleasant memories to encourage and cheer

JOHN B SHAPLEIGH

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD APRIL 18 1925 DR CAREY CULBERTSON PRESIDING

### HEMANGIOFIBROMA

DR RALPH A REIS presented a specimen of a hemangiofibroma of the placenta from a patient of Dr Joseph L. Baer at Michael Reese Hospital.

This patient was a para who had had an uneventful pregnancy and went through a short and easy labor being delivered of a normal full term baby. The placenta was expressed after 5 minutes and was found normal in all respects except for a large hard smooth tumor on the fetal surface 6 centimeters in diameter and projecting 3 centimeters above the surface. The tumor was well encapsulated and its outer surface was smooth and glistening. It was sectioned and was red fleshy and of cellular appearance. At the periphery there was an irregular yellowish pink area which was sharply demarcated from the rest of the tumor. There were small firm circular areas which appeared to be about blood vessels.

The report of the pathological department of the Michael Reese Hospital is as follows: Section taken through the mass shows it to be made up of large numbers of small blood spaces in which quite frequently red blood cells can be seen. In some areas these are separated by an edematous fibrous stroma the fibroblasts of which have vesicular active nuclei. Other areas are more cellular and the vessel are represented by endothelial cords. There are some discrete areas of necrosis in which vessels may still be seen and which are sometimes hemorrhagic. Around the larger vessels there is a well marked tissue envelop which also contains a few vessel spaces. Section through the placental tissue itself shows a normal decidual and fetal picture.

A second case of Dr Baer's tumor of the placenta a hemangioma was seen shortly after the above case was reported. The patient was a para who had an uneventful pregnancy and a normal labor and was delivered of a full term normal baby. The placenta was expelled spontaneously and was found to contain a small egg shaped mass measuring 4 by 3 by 3 centimeters. The mass lay beneath the amnion was well encapsulated and was differentiated from the remainder of the placental tissue. Section through this mass showed several large vessels and many small rounded masses of light red tissue which were soft. One large area was firm and hemorrhagic.

The report of the pathological department is as follows: The tumor is a hemangioma of the placenta.

Microscopic section shows large numbers of closely packed thin walled blood containing vessels surrounded by necrotic tissue which do not stain well. The surrounding placental tissue shows a considerable amount of canalized fibrin and other characteristics of late pregnancy.

### CONGENITAL ABSENCE OF BOTH LUNGS

DRS ALLEN and APPELBACH. Congenital absence of the lungs is a very rare condition and we felt that the case that came to us recently should be reported.

In going over the literature we find that Ellis<sup>1</sup> and Levy have reviewed 22 cases of congenital absence of one lung but there is only 1 case recorded that we could find of absence of both lungs. Schmitz<sup>2</sup> case report is rather detailed and we will review only the most important pathological findings.

The fetus was 44.5 centimeters long of about 8 months gestation and well developed. On either side of the occipital protuberances were small processes of bone encircling the occipital foramen and fused with the second cervical vertebra probably a rudimentary atlas. The liver extended to the seventh rib on the right side and to the second rib on the left. It had a small accessory lobe on the left side. The foramen epiploica was closed.

There was a rather large cavity in the upper air passages formed by larynx pharynx trachea and oesophagus. The trachea and oesophagus communicated for a distance of 18 centimeters and the tracheal lumen gradually fused with that of the oesophagus. There were only 10 cartilaginous rings in the trachea and they grew smaller as the fusion with the oesophagus was reached.

There was a complete absence of pleural cavities. The diaphragm was at the eighth rib on the right and at the fourth on the left side.

The space on the left was filled with fatty areolar tissue. On the right side the heart and pericardial sac filled up the space. The aortic side of the heart and the aortic system were normal. The pulmonary artery emptied into the aorta. There was a large patent foramen ovale. There were no openings of pulmonary veins into the left auricle.

The case which we wish to report is as follows.

Mrs C D U 19 gravida age 29 entered the Presbyterian Hospital February 9 1925. She had had

Ell. Am J Med Sc 9 7 11 33  
S hm A ch L path Anat 303 22 14 5

two normal pregnancies and 1 live birth and one un-  
complicated miscarriage. Her last pregnancy ended  
August 15, 1923, 2 weeks before term after 7.4 hour  
labor. Both previous children were normal. The  
last menstrual period was March 17, 1914.

The patient went into labor spontaneously Febru-  
ary 13 and was delivered of a female infant  
weighing 5 pound ounces. The 6 hour labor and  
delivery were normal except that the fetal heart  
tone dropped to 90 immediately preceding delivery.  
The membranes were ruptured artificially with  
dilatation was complete.

The baby was pink and made an immediate effort  
at respiration. Very little mucus was obtained with  
the tracheal catheter. During the next 10 minutes  
of artificial respiration about 8 or 10 spontaneous  
efforts to breathe occurred. Mouth to mouth in-  
sufflation was tried but the air returned through the  
infant's nose and no expiration with the chest occurred.  
Artificial respiration was continued for 20 minutes  
after the heart had stopped beating.

The pathologist reports as follows:

This is the body of a white female child 47 centi-  
meters long weighing 5 pound. There is a small  
amount of thin light brown hair on the scalp 5 to  
10 millimeters long. The eyes are blue. Body nour-  
ishment good. The anus is perforate. The bony  
skeleton is symmetrical.

In the peritoneal cavity there are about 5 cubic  
centimeters of clear light yellow fluid. There  
are no gross noteworthy changes about the upper  
surface of the liver, pleural gall bladder appendix  
verruca, this pelvic organs or of the tissue about  
the abdominal portion of the aorta. The diaphragm  
on right side extends up to upper border of fourth  
rib on left side to middle of fourth rib.

When the sternum was removed at least three-  
fourths of the thoracic cavity was occupied by the  
heart and pericardial sac. The pericardial sac is  
broad extending from the ribs on one side to those  
on the other. The pleural cavities are empty. The  
maximum length of the pleural cavity on the right  
side is 3.5 centimeters, on the left 4.5. The front  
margin of the pleural cavity is slightly in front of  
the anterior axillary line. The posterior anatomical  
boundaries are formed in the usual way. There is  
considerable fat in the mediastinum in the upper  
one-fourth. The maximum transverse diameter of  
the heart is 5 centimeters, the maximum height 2.5.  
The heart is made up equally of right and left ven-  
tricles. The pulmonary artery has no branches and  
empties into the aorta at the usual location of the  
mouth of the ductus Botalli. The foramen oval is  
patent and has a maximum diameter of 6 milli-  
meters. There are no grossly visible vessels enter-  
ing the left auricle. There is no change of the leaflets  
and cusps of the cardiac orifices.

The wall of the esophagus is intact throughout  
its course. The trachea ends blindly at the level of  
the root of the heart. The circumference averages  
8 to 9 millimeters. The inferior end is rounded but  
on each side there is a pouch about 1 millimeter

deep. The pleural cavities at the level of the inferior  
end of the trachea are slightly puckered being dra-  
wn toward the midline for 0.5 to 1 millimeter in a place  
about 2 millimeters wide. Grossly there is no tissue  
resembling lung in the pleural cavity or in the medi-  
astinum about the inferior end of the trachea.

There are no gross malformations of the kidneys,  
adrenal glands, pancreas, gastrointestinal tract,  
uterus and its appendages, of the organs of the neck  
and mouth or the cranium and its contents.

*Microscopic examination:* In paraffin sections of  
the lower end of the trachea and surrounding tissues  
stained with hematoxylin and eosin there is nothing  
that resembles lung tissue.

## DISCUSSION

DR J. B. DELEF: I would like to ask the mem-  
bers if they have noticed any increase of births of  
monstrosities of late. We have had during the last  
3 or 4 weeks a veritable epidemic of monstrosities.  
We have had one anencephalus, one cephalocele,  
one pinabifida, one congenital heart disease with  
fluid in both pleural cavities in an otherwise per-  
fectly normal baby which without postmortem  
would have been diagnosed as hyaline, one double  
congenital hydrothorax, one fistula between the  
trachea and esophagus, the baby dying of broncho-  
pneumonia. Yesterday there was another one with  
an amputation of one leg near the pelvis.

DR EMIL REIS: This specimen is of the greatest  
interest on the question of why a baby breathe the  
first time a question for which no satisfactory an-  
swer exists. Here we have a baby which according  
to the report made an attempt to breathe without  
lungs. Why does a baby without lungs attempt to  
breathe? The next question is when there is no  
lung in the chest cavity and the chest-cavity is not  
completely filled by the heart and the abdominal  
organs pushing upward, what is in that space not  
occupied by the lung? Of course that space may  
not have been found until postmortem. Before the  
chest was opened there may not have been any space.  
That cannot be known until someone makes a post-  
mortem on such a case and opens the chest under  
water so no air can get in. Is it possible that there  
was a vacuum in the chest? Is the chest wall strong  
enough to support a vacuum or the explanation of  
the first respiration based on the disproportion be-  
tween the space supported by the ribs, sternum and  
vertebrae and the contents of the chest?

DR N. S. HEANEY: This case is an extremely in-  
teresting and rare one. One feature that was strik-  
ing was that the child was very small and I felt that  
the mother must have made a mistake in the time  
of her last period.

DR CHARLES B. REED: We have all been accus-  
tomed to the truth of the mechanical theory that there  
is an equality in pressure between the space inside  
the thorax and the atmosphere outside. I have  
always been under the impression that the first  
respiration due to an accumulation of carbon

dioxide in the blood whereby the respiratory center in the pine is stimulated. The function of breathing is thus inaugurated and air rushes into the chest. I do not believe that the mechanistic theory is correct. The child breathes because the initiation of a new function compels it.

### THOMAS J. WATKINS

Dr. Charles S. Bacon presented a short sketch of Dr. Watkins' life following which he offered the resolution:

The Chicago Gynecological Society desires to express its sense of a great loss in the death of one of its most valued fellows, Thomas J. Watkins. His skill as a surgeon combined with a fine spirit of research, absolute honesty in his professional and

scientific work and his ability as a teacher were the qualities that gained for him a local national and international reputation of the first rank. In this we rejoiced for his generosity and loyalty to his students and colleagues and his kind sympathy to all honest work made impossible jealousy or envy or any other sentiments than those associated with esteem and affection. His interest in the Society never waned and was manifested by regular attendance and frequent contributions to its programs.

The Chicago Gynecological Society wishes to inscribe upon its record this appreciation of its fellow and to express to his family and friends its deep sympathy in their loss and to offer its congratulation that the memory he has left behind is so pure and inspiring.

## CORRESPONDENCE

### ELBOW FRACTURES AND DISLOCATIONS

To the Editor: My attention has been drawn to the fact that the splint described in *SURGERY, GYNECOLOGY AND OBSTETRICS*, vol. xl, p. 673, in my article on Fractures and Dislocation was one that had been used in the ward of the Bellevue Hospital for some time and that in the development of the splint Dr. Frederick W. Marx was on the

scene at that time and had a prominent part. While the splint has been modified in certain ways and the principle of elastic extension had been used on the service for some years we wish to give Dr. Marx full credit for his assistance in devising this splint.

IRWIN L. SIRIS

New York City

### BOOKS RECEIVED

Book received: A guide in this department of the knowledge of the reader of the book. The author is Dr. F. W. Marx.

AN LES DE SANATORIO VALDES. I. M. City. M. C. B. L. y. & Schm. dt. 95.

CHIRURGISCHE PROPÄGANDA. EL. E. ALLG. MEINE. CHIR. CHE. DIAG. OSTI. FUER. STUDIEN. DE. UND. ZE. ITE. By Prof. Dr. L. L. S. nt. G. L. p. G. g. Th. cme. 195.

THE. ATIO. AL. CL. IC. A. OL. RTER. OF. ILLUSTRATED. C. INICAL. LECT. ES. AND. ES. CTALLY. I. FP. ED. ORIGIN. L. ARTICLES. V. I. Edited by H. ry. W. C. ti. ll. AM. MD. Ph. ladelphi. J. B. L. pp. tt. C. 95.

DISEASES OF THE EAR, NOSE, AND THROAT. By H. r. ld. H. y. MA. MD. FACS. Ph. l. d. lphi. I. A. D. C. mp. y. 195.

OPERATI. G. ROOM. PROC. LR. OR. NL. ES. A. D. I. ES. By Henry. C. F. lk. MD. with. f. w. d. By. E. gn. H. Pool. MD. N. w. k. d. Lond. C. P. P. t. am. So. 95.

MET. ODS. IN. SURGERY. USED. IN. THE. S. GICAL. DIV. IO. S. THE. BA. NE. HO. PITAL. ST. LOUIS. C. IL. EN. S. H. 871. TAL. AND. WA. HINGT. N. U. I. ER. ITY. D. FE. SA. Y. IL. CL. UD.

1. G. OUTLINES. R. CA. E. HISTORY. TAKING. PRE. OPERATIVE. AND. PO. TOPER. TIVE. CAR. OF. PATIENTS. ROUTINES. DIETS. ETC. By. Gl. r. H. C. ph. r. MD. St. Louis. C. A. M. by. C. mp. ny. 95.

B. LO. E. UND. PATHOLOGIE. DES. WEIBES. EIN. HAND. BUCH. DER. FRAUENHEILK. UND. GEBURTS. ILFE. Ed. t. d. by. J. ph. II. lb. and. Ludwig. S. tz. Li. serung. 15. pp. 335. 556.

AN. SYNOPSIS. OF. SURGERY. By. E. nest. W. Hey. G. MS. MD. B. Sc. (Lond.) I. R. CS. (Eng.) 7th. ed. New. Y. rk. Will. m. Wood. & C. 95.

A. SYNOPSIS. OF. MIDWIFE. Y. AND. GYNECOLOGY. By. M. k. W. B. n. BA. MB. B. Ch. (C. mb.) F. R. CS. (Fn.) 3d. ed. New. Y. k. Will. m. Wood. & C. 95.

E. ZYME. INTELLIGENCE. AND. W. IENCE. AND. WHITHER. By. N. l. Q. l. Reg. Pha. LL. B. M. n. pols. M. esota. Th. C. I. ll. Pe. I. c. Lake. f. ld. M. n. e. t. St. nd. rd. Book. C. mp. y. 195.

DIE. GY. AEKLOGIE. DES. PRAKTISCHEN. AR. TES. By. D. F. st. R. g. dr. ed. Berl. n. d. Vi. n. U. ban. and. Sh. w. r. nbe. g. 195.

DES. KINDES. FRN. EHRUNG. ERNAEH. LUNGSSTO. RUNGEN. U. P. E. NAEHRUNGSTHERAPIE. By. Pr. lessa. Ad. C. erny. f. Prof. soo. A. h. ll. vol. II. No. 1. Leip. g. d. Vi. n. f. nz. D. t. k. 925.

# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN, M.D., F.A.C.S., OMAHA, NEBRASKA

### THE PHARMACOPŒIA AND GARDEN OF MILITARY SURGERY

WITH the above as the beginning of its title a most interesting little surgery was published in the latter part of the sixteenth century. The full title translated rather freely reads: *Pharmacopœia and Garden of Military Surgery* containing the instruments and plants necessary to all Surgeons with lists of certain ingredients proper for each organ both medical and mechanical. Dedicated to the high and mighty Seigneur M. François Gouffier Sire of Crevecoeur Chevalier of two orders of the King etc. Further a treatise of antidotes and cure of the Peste and declaration of a question the whole tried out and brought to light for the use of the public by Esau le Lieure Surgeon. At Paris by Robert Coulombel rue Saint-Jean de Latran at the sign of Aldus 1583 with the privilege of the King.

The functions of a book are numerous and one of the most prominent is its appeal and the reason for this appeal may lie in any one of several things. It may be more understandable to say: Why do we like this or that book? It may not be the contents for many books especially from the collector's standpoint have an appeal which has no relation to the contents. Of course one of the first drawing points is the format and here a little book that from its very make up is attractive. There is something about a thin small book just the right size to fit the coat pocket beautifully printed whose paper crackles and whose type is clear and well blocked out on the page that seems to give an invitation which says: look me over read me and see if you cannot find something that you like. It is just so with this little *Garden of Surgery* by an author who is practically unknown. I say this because he is passed over with scant mention by some and wholly ignored by others of the medical historians in whom we place confidence. But nevertheless the book is fascinating. It makes its first appeal because it looks interesting. Then the title intrigues the curiosity. *Officines et Jardin de Chirurgie Militaire*. Call it pharmacology pharmacopœia or dispensatory and garden or what you will but we get the vision of the garden where the herbs and flowers grow which are to be employed to make the various lotions and ointments to be used on the wounds described by the author most of which are war wounds for Lieure was a surgeon who had followed the wars and he tells us that what he advises he knows as the result

of personal experience and trial. He shows by his illustrations how the flowers and plants we are to gather appear so we will make no mistakes and just how we are to use them in making our preparations. In fact the latter part of the book is a miniature Herbal.

In the dedication the author endeavors to stimulate his patron Seigneur François Gouffier to follow the example of King Francis I in establishing a school of surgery the one to be in Picardy but in this he was apparently not successful. He hints at this but he directly expresses the hope that the dedication of his volume will result in the practice of true surgery in Picardy directed and sustained by the desires and power of Gouffier.

From this we learn that Lieure was a surgeon of Picardy and here another appeal of this little book enters. The very name of Picardy brings visions of almost all of war surgery. The mind reverts to the days of Crœvus and Agincourt and we visualize King Henry V with his little army of a thousand men at arms and six thousand archers against forty times their number of the French weighted with armor fighting in the mud. Here the wounds were made by the mace and arrow. A little later the first St. Quentin in 1557 where cannon and the harquebusse came into play and wounds such as these of which Lieure wrote were made and treated. Then a later St. Quentin in 1871 with higher powered arms and more penetrating wounds and finally that line through Picardy from 1914 to 1918 and we think of the Somme and Soissons Montdidier and another St. Quentin with the ripping tearing wounds of shrapnel and shell and high explosive. Through all this period is the search by surgeons for the

*Therapia Sterilans Magna* in the sixteenth century the flowers and herbs of Lieure and in the twentieth inorganic and organic chemical compounds. But let us listen to Lieure on the treatment of wounds.

The first intention of the surgeon consists primarily in the ablation of foreign bodies. It is expedient to begin with the execution of the above intention and this will be necessary not only in wounds made by arquebusses and pistols but also in all others. And he goes on to describe pieces of bullets and darts and also clothing harness and gangrenous contused and mortified tissue—all of which must be removed. And then we pass on three centuries and more and after a search of 4 years for the ideal antiseptic we sum up all he said in the single word—débridement.





## REVIEWS OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GELLHORN, M.D. F.A.C.S. St. Louis, Missouri

THE three textbooks before me represent a veritable embarrassment of riches. The work of Graves<sup>1</sup> has made its third appearance. The author looks upon gynecological ailments not as isolated phenomena but sees them in relation to the general organism. There is therefore a lengthy introduction of 178 pages—one fifth of the entire book—which is given over to a detailed consideration of the intimate reciprocal connections between the pelvic organs and the other organs of the body in health and disease. The author himself thinks that this first part of his work would be suited more for the advanced special student and the general practitioner but I believe that in the instruction of undergraduates one can not begin too early to widen the horizon of the pupil and to teach gynecology from the very start as a part of general physiology and pathology. The young physician will then be left apt to look at the world through a vaginal speculum as Abraham Jacoby once observed tersely.

The second part deals with gynecology in the usual sense of the word. It represents organ pathology proper and describes the subject in a compact form. The discovery by Sampson of endometrial transplants has rendered necessary many changes in the interpretation of pathological lesions in the female pelvis. Syphilis of the internal organs is another new subject.

In the third part on operative gynecology the author presents chiefly the surgical procedure which have proved successful in his personal experience. A large number of illustrations both in black and in color many of them from the author's hand support the lucidity of the verbal expression. The pleasing make up of the work correspond with the excellence of its contents.

THE next book is Anspach's *Gynecology*<sup>2</sup> which is now in its second edition. Here too we meet with a wider concept of gynecology in such chapters as the hygiene of the adolescent girl, causes of pelvic disorders, backache, etc. I am again impressed as I was when I reviewed the first edition with the thorough and careful preparation of the work which provides the reader with an authoritative guide to the accurate diagnosis and the successful treatment of the gynecological conditions most frequently encountered. In addition to complete reviews on radiotherapy and perineorrhaphy, numerous new subjects have been embodied such as the Rubin test, granuloma inguinale, mercurochrome as an intravenous antiepileptic, varicocele, protein

therapy, etc. and the bibliographic references at the end of each chapter have been brought up to date. The author's own research particularly in the field of the metropathies should receive special mention. The work possesses all the qualities of a helpful textbook for students and practitioners.

BLANDS' *Gynecology*<sup>3</sup> is a newcomer in the literary field and for that reason is entitled to a more detailed review. The book is composed of 20 chapters of which the first nine may be considered the introductory part of the work. The first chapter deals chiefly with the phenomena of puberty and menopause. The second chapter presents a lucid survey of the various causes of genital disease. In the following chapter on symptomatology the author stresses the importance of careful observation of the patient as a whole and the exercise of judicious judgment. The recognition of a single lesion must not be accepted as a necessary explanation of all the associated symptoms. There is also a good diagram which shows at a glance the relations between local and general symptoms in gynecological ailments. The next chapter gives very clear descriptions of the various diagnostic methods among the newer means roentgenography and pneumopneumum, the Rubin test and Heineberg's uteroscopy are highly recommended. In contradistinction to this progressive attitude the advice to introduce the uterine sound merely under the guidance of the fingers strikes the reader as a backward step into the days before asepsis. A separate chapter is devoted to the exploration of the urinary tract. The following chapters deal with preoperative routine, postoperative treatment and postoperative complications. A lengthy chapter on non-operative treatment follows. The author is somewhat apologetic about devoting so much space to conservative therapy but he may rest assured of the approval of those who realize that the pendulum is swinging back from the former almost exclusively surgical treatment of genital disease. In the second part of the book the author presents in separate chapters disorders of function, malformations, traumatic inflammations, ectopic gestation and tumors. Whenever possible he considers the various morbid conditions in sequence from the vulva to the pelvic cellular tissue a plan which lends itself well to the discussion of such processes as inflammations, tumors and injuries.

Extensive personal experience, clear diction and an abundance of illustrations combine to make the book helpful to the general practitioner and the specialist. Yet there are some criticisms which

Graves, *Gynecology*. By W. H. P. G. es. A. B. M. D. F. A. C. S. and ed. 1st ed. 1914. By L. E. W. B. es. d. r. c. m. p. a. 3.  
Anspach, *Gynecology*. By Brook. M. A. p. a. M. D. ed. 1st ed. 1914. d. Lo. d. J. B. Lippincott Co. p. a. 9. 4.  
Sur. Gynec. & Obs. 2nd Ed.

Graves, *Gynecology*. By W. H. P. G. es. A. B. M. D. F. A. C. S. and ed. 1st ed. 1914. By L. E. W. B. es. d. r. c. m. p. a. 3.







ditions in women. The diction is none too fluent and the technical phraseology rather unfamiliar to gynecologists. But the reader will feel richly repaid for the extra effort in studying this article for it opens up avenues of new ideas and knowledge. The so-called weaker sex, the author claims, is in reality superior to man both psychologically and physically if one only analyzes the situation carefully. He believes that in America the domination of woman over man has reached its extreme expression. The relationship of the two sexes particularly in psychological and sexual respects is that of rider and horse. The author studies the psyche of woman as if under a microscope and what he says of woman in the various stages of her sexual development and activity of the sphincter of the woman in various professions offers food for serious thought. The prognosis he gives to women in medicine is not very encouraging. His excursions into social hygiene, prostitution and criminality in women are absorbingly interesting.

Kogrer deals with neuroses in connection with menstruation, menopause, pregnancy, puerperium and lactation and the legal responsibility of women delinquents during these states. The short article is of considerable importance to the gynecological reader.

Psychoses in women form the subject of Ewald's contribution. The tenor of the essay is that specifically female sexual psychoses do not exist. Contrary to traditional beliefs, normal or disturbed sexual function are merely incidental factors in the outbreak of a psychosis. Psychic derangements in men and in women have the same symptomatic development and course.

Albrecht presents a concise chapter on psychopathia sexualis. Involuntarily one thinks of Krafft-Ebing's fundamental though rather sensational monograph of the same title and of certain less sincere books on the same subject and in different languages in which many of these sexual aberrations were dished up in a way so as to tickle the eroticism of the reader. There is nothing of this in Lertone in Albrecht's dissertation. The author maintains if at all that a voluminous literature on the subject is by no means thoroughly understood. The main reason is that the sexually psychopathic person consciously or unintentionally is only too often a liar. When all is said we must be content with knowing that such psychopathic conditions exist and in the matter of treatment we are practically helpless.

Of far-reaching practical and scientific value is the work by Novak on the relations between the female genitals and the ear, nose, pharynx, larynx, muscles, bones and gastrointestinal tract. The author some years ago contributed a similar treatise in Vothen's great handbook of internal medicine. He has now brought the subject up to date. His encyclopedic knowledge and his amazing industry must fill the reader with honest admiration. It is utterly impossible to attempt detailed excerpts from the mass of valuable information. It is my conviction

that familiarity with these borderline or related subjects will be the distinguishing mark of the gynecologist of the future.

Reiferschei's contribution deals with the various applications of the uterus. The author has written a typical textbook chapter well suited for the beginner but hardly sufficient for the specialist. Details of operative technique for instance are lacking. The time-honored Alexander Adam method however has again the seat of honor. What a powerful factor is tradition! I hope that some day a gynecological revolution will rid us of inherited but useless turn of mind.

The chapter written by Nettenberger is in reality a monograph of almost 200 pages on sterility. One can speak of this treatise only in words of highest praise. The subject has been considered exhaustively from every viewpoint—biologically, clinically, therapeutically. Never lose sight of the man's share in female sterility. In one third of the cases he is the direct cause, in another one third the indirect one (oligorrhoea) and only in the remaining third is the cause found in the woman herself.

Ovarian sterility should be more often recognized as an etiological factor, but ovarian extracts are practically of no value. A bibliography of 50 references testifies to the thoroughness of the author.

I know has succeeded in presenting a clear survey of the difficult and complicated subject of sterilization. Legal, social, hygienic and social-economic questions had to be considered. The problem of contraception and interruption of pregnancy lies by no means solely on medical grounds. In its last analysis the conscience of the physician must be the deciding factor. The medical indications which from the present state of our knowledge demand interference are presented according to degrees and thereafter followed by a discussion of the mechanical, chemical and operative means at our disposal. Twelve large pages of references in very small type give this article too the stamp of thorough preparation.

A French publisher has recently brought out a series of monographs on cancer of which the one by Faure on cancer of the uterus is of interest to us. The well-known author devotes the greater part of his book to a detailed consideration of cancer of the cervix which he views largely from the standpoint of surgical treatment. Radiotherapy should be resorted to inoperable cases in which its palliative effect is infinitely superior to all other means but it has no place in operable cases. If applied in the latter after operation it is apt to bring about recurrences and if used pre-operatively, it stirs up the cancer cells to greater activity and thus vitates the results of a subsequent operation. The operation of choice must be the extended or radical abdominal hysterectomy, the so-called Wertheim operation. Thanks to the perfection of the technique of this

operation admirable results may be obtained and cancer of the cervix is very often cured permanently. The immediate results of the operation can be still further improved and the high primary mortality reduced greatly by the systematic use of the Mickulicz tampon.

The thoughtful reader may already have felt some mental reservation regarding these somewhat categorical statements of the author and he will wish to know the statistical proof on which Faure bases his conclusions. Such statistical data, however, are extremely meager in fact; they appear only in the form of a footnote. One may freely admit the fallacy of statistics as they are presented so often, but one cannot possibly ignore the value of statistics altogether—least of all in a question in which so much depends on accurate facts and in which impressions and opinions count for so little. Moreover, one may hardly speak of cures as Faure does in patients who have been operated upon less than 3 years ago and it seems preferable to me that all writers on the subject of uterine cancer should adopt the 5 year limit which is proposed as an international standard.

In sketching the history of the radical operation for cancer of the uterus the author suggests that the honor of its conception belongs to Ries rather than to Wertheim. Having myself for many years emphasized this very point I feel in accord with Faure in the matter. It is the old story of Columbus and Amerigo Vesputi and the naming of the continent.

While this book is disappointing in some respects it is interesting and instructive in many others. It reads extremely well and ends with a hopeful note which, while not entirely warranted by actual experiences, is so very helpful in buoying up the optimism one needs in the fight against cancer—until the victory!

**T**WO very thorough scientific contributions have emanated from the Department of Gynecology and Obstetrics of the University of Naples. These studies are published as supplements to the Italian archives of obstetrics and gynecology but as a matter of fact represent monographs of 250 pages each.

In the first of these treatises Bonaretti subjects the human placenta at term to a searching investigation and divides her subject into macroscopic anatomy, microscopic anatomy, and retrograde changes. A large number of good photomicrographs testifies to the extensive personal work of the authoress. The thoroughness of the monograph may be judged from the bibliography which covers 32 pages and contains practically all of the Italian as well as the foreign literature. This volume will be a very useful reference to research students of this subject.

**T**HE second treatise deals with the thyroid in pregnancy. After three introductory chapters on the structure, the function and the relations of the thyroid to the genital system, the first part is devoted to an exhaustive presentation of our present knowledge of the behavior of the thyroid in pregnancy and contains chapters on the anatomical, functional and biochemical changes and the mechanism of their development. In the second and considerably larger part the author reports his own researches which have been carried out on 181 women and a number of experimental animals. The conclusions are as follows: In the large majority of the cases the thyroid increases in size during pregnancy and labor; in the puerperium there is a rapid decrease, but in about half the cases a transient increase is noted coincident with the appearance of milk, very rarely also on the seventh day post partum. The increase in size during pregnancy is due only in a small percentage of cases to hypertrophy and to a much larger extent to hyperæmia and retention of colloidal substance in labor and the puerperium it is almost altogether produced by hyperæmia. The histological and biochemical changes are to be interpreted as a state of hyperfunction; they differ in degree not only in various animals but also in individual of the same species. The iodine content is slightly increased in pregnancy. The hyperfunction of the human thyroid in pregnancy is quickly reduced to the normal in the puerperium. The clinical manifestations consist of a slight hyperthyroidism and dysthyroidism occasionally one or the other manifestation or both may be absent. The hyperfunction is almost constant in pregnancy, yet it is not necessarily a concomitant symptom of the latter. All pregnancy changes of the thyroid are largely due to the interruption of ovarian function; the rest of the genital organs probably play some part.

This monograph impresses me as a very valuable study and I may add that in the extensive bibliography American literature has been quoted extensively.

**R**ACE Hygiene and Heredity is a serious and scientific plea for a thorough and general understanding of biology, heredity and the social, moral and political application of eugenics. The noble and cultured members of our white civilization go the way of the gods of Athens and Rome. Most of the comfortable little volume is devoted to the evolution of the theories of biology, which it expounds rather too scientifically for the average American who in certain unenlightened quarters legislates against even the teaching of evolution! Dr. Siemens, a profound German scientist, illustrates historically the development of the laws of heredity down to the

A. TONIA LA PLACE LMA T By P of Dr Maria  
E. Ital. Colla Bonaretti. 5 pp. 1911. Il Archivio di Ost. Ginec.

Lo S. TO. ELIA T. ON G. TO By D. F. MO  
punto 5 pp. 1911. Arch. v. 10. Ost. Ginec. 1911.  
R. York D. Appl. Gen. Comp. y. 9. By Stern W. S. M. M. D.

present moment of our recent and intimate acquaintance with cytology

His treatise I fear will never be as accessible to the average reader as Wiggam's *Fruit of the Family Tree* because it is less popular and psychologic and much more technical and detailed. For instance the implications of this phrase "We are all extremely multiplicit heterozygotes" would presuppose a more intelligent intimacy with biology and Greek than even most educated Americans can boast. Or this excerpt "The chief mechanisms that improve our people (German) in a paratypic way are public health movement education by schools and churches certain parts of social legislation and before the war—military service" would tickle our national sense of humor rather than stimulate our hygienic and social conscience.

But this does not reflect upon the merits of the valuable and compact little book of Dr. Siemens who discusses many vexing problems such as degeneration inherited characteristics inbreeding etc. with an authority that must leave its impress. He deplors the economic complications that make for the practice of voluntary parenthood among the most valuable groups of our population and he advocates a birth polity administered through carefully regulated taxation and public education that will induce the capable educated and professional classes to become sufficiently prolific.

He ends with a threatening pessimism when he says "Unless these requirements can soon be met we scarcely dare hope that the race-destroying economic policies and the moral views of the Occident that are inimical to life can be overcome before it is too late. For only after these requirements have been met can the time come when we may finally be done with the cruel folly that through laws that seem senseless to the biologist exterminates the most valuable elements of our people."

**THE Hygiene of Marriage** is a textbook on sex hygiene. The problem of this type of book is to steer a middle course between the Scylla and Charybdis of over and understatement of facts. Either practice may wreck the amateur explorer for whom such books are intended for pathological sex stimulation and secret eroticism are everpresent and

dangerous pitfalls in all sex instruction. In spite of the possible harmfulness of such books education along these lines is absolutely necessary. Whether such education should begin with the infant adolescent or prospective bride and groom is a matter upon which social experts and doctors sometimes disagree. However the book *Hygiene of Marriage* is one of the most unoffending of the many dealing with sex questions that the reviewer has yet discovered.

Dr. Hutton herself says of her book "it may seem crude in the reading for nothing more than the necessary physiological and anatomical aspects have been touched." She accomplishes this in as comprehensive and unspectacular a manner as her subject which for ages has been exploited in sin, shame and salaciousness permits. Still Dr. Hutton does not neglect the art and aesthetics of marriage. This phase she handles with a common sense that robs it of prudishness and affectation. She insists that a happy home is largely dependent upon the intellectual attitude of the homemakers toward the demands and the compromises of sex.

Chapter I makes a plea for a proper evaluation of all the factors that play a part in a happy and healthy marriage. Dr. Hutton insists that too much emphasis is laid by society upon the economic fitness and marriage settlements. She says "There is no doubt that the great majority of unhappy marriages are due to the abnormality in sex life."

It is therefore of the utmost importance that those entering upon marriage whether young or old should be prepared. The succeeding five chapters offer this preparation. They deal with questions of health disease and physiology with simple dignity and unprejudiced completeness. They emphasize no one phase and attack such difficult subjects as frequency of intercourse adjustment impotence and contraception about the use of which she is somewhat conservative with a directness and naiveté that sublimates her book into social and philosophic channels. When however she gives instructions regarding the performance of the sexual act one wonders whether she might not have taken much for granted. One closes the book with the distinct feeling that if preparation in sex hygiene is ever to be of practical benefit before actual experience such preparation must come through efforts of educators like Dr. Hutton.

THE HYGIENE OF MARRIAGE. By Isabel Emshoff, M.D., London. W. H. Freeman & Co., Ltd.

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

CHARLES H MAYO Rochester *President*

RUDOLPH MATAS New Orleans *President Elect*

FRANKLIN H MARTIN Chicago *Director-General*

## PHILADELPHIA COMMITTEE ON ARRANGEMENTS

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WARREN B DAVIS *Secretary*

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FLOYD E KEENE

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STEPHEN E TRACY  
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A D WITTIG

## PRELIMINARY PROGRAM FOR THE PHILADELPHIA MEETING

IN the following pages will be found a tentative program for the evening meetings for the Philadelphia session of the Clinical Congress of the American College of Surgeons as arranged by the Executive Committee of the Congress. It will be noted that all of these meetings are to be held in the Ballroom of the Bellevue Stratford. At the Presidential meeting on Monday evening the President Elect Dr Rudolph Matas of New Orleans will deliver his inaugural address and Sir Arbuthnot Lane of London England the Murphy Oration in Surgery. At the convocation on Friday evening the Fellowship Address is to be given by Lord Dawson London England physician to King Edward.

The preliminary clinical program is being reprinted in this issue. This program still in a tentative stage is to be revised and amplified previous to the meeting so that the final program will fully represent the clinical activities in

Philadelphia in all departments of surgery. The real program of the Congress is to be issued daily during the session giving in complete detail a description of the clinics and demonstrations at the several hospitals and medical schools. This program will be issued in the form of bulletins posted each afternoon at headquarters for the following days clinics. A printed program will be issued each morning.

A series of clinical demonstrations or dry clinics in which surgeons internists pathologists roentgenologists and other specialists will participate to discuss some of the more important phases of surgery forming an important feature of the clinical program are being arranged at a number of the larger hospitals.

Of special interest to those engaged in the practice of ophthalmology and otolaryngology is the program of papers and demonstrations prepared by the Committee to be given in the Ballroom on Wednesday Thursday and Friday

mornings at nine o'clock supplementing the clinical work in the hospitals in the afternoon.

General headquarters of the Congress will be established at the Bellevue Stratford Hotel Broad and Walnut street where the entire first floor including the Ballroom, Clover Room, Link and Club rooms together with the Stratford Room on the main floor and the Rose Garden and other rooms on the roof have been reserved for the exclusive use of the Congress. These rooms provide ample space for evening meetings by means of an hospital organization headquarters, registration and ticket bureau, bulletin room, etc.

The clinical program for Tuesday will be posted on bulletin board during Monday afternoon and reservation for ticket for Tuesday clinics may be filed late that afternoon.

The annual meeting of the Fellows of the College will be held in the Ballroom of the Bellevue Stratford on Thursday afternoon at three o'clock to be followed by the annual meeting of the Board of Governors.

Since the last session of the Congress in Philadelphia in 1921 there have been erected in that city a number of fine large hotels situated within easy walking distance of the Bellevue Stratford so that the hotel situation in that city has been greatly improved. A list of the Philadelphia hotels recommended by the Local Committee on Arrangement together with their rates will be found on another page.

#### HOSPITAL CONFERENCE

In this issue will also be found the preliminary program for the annual hospital conference to be held on Monday, Tuesday and Wednesday both mornings and afternoons at the Bellevue Stratford. Addresses, demonstrations, round table conferences and general discussions by surgeon, superintendents, trustees, nurses and others interested in the conduct of hospital deal intimately with the details of hospital standardization and management providing a program of very great interest and practical value in treating many of the everyday problems and difficulties encountered in hospital management and the care of the patient within the hospital.

At the opening session on Monday morning Dr. Franklin H. Martin, Director General, will present his report including a list of the hospitals which appear on the approved list for the year 1925.

A hospital information and service bureau in charge of Dr. M. I. MacEachern, Executive Director in charge of hospital standardization

activities will be maintained in the Congress headquarters throughout the session to give assistance to any hospital seeking solutions of its troublesome problems. All who are particularly interested in hospital problems are requested to register at hospital standardization headquarters upon arrival at Philadelphia. A general invitation is extended to hospital trustees, members of the medical and surgical staffs and hospital personnel generally to attend the conference.

#### REDUCED RAILWAY FARES

The railways of the United States and Canada have authorized reduced fares in accordance with the Philadelphia session of the Clinical Congress so that the total fare for the round trip will be one and one-half the ordinary first-class one way fare. To take advantage of the reduced rates it is necessary to pay the full one way fare to Philadelphia procuring from the ticket agent a convenient certificate when purchasing such ticket which certificate must be deposited at headquarters for the use of the special agent of the railway companies. Upon presentation of valid certificate to the ticket agent in Philadelphia not later than November 3 a ticket for the return journey by the same route as traveled to Philadelphia may be purchased at one-half the regular one way fare.

In the eastern, central and southern states and eastern provinces of Canada tickets may be purchased between October 22 and 28 in southwestern and western states between October 1 and 27 and in the far western states and western provinces of Canada between October 16 and 22. The return journey from Philadelphia must be begun not later than November 3.

The reduction in fares does not apply to Pullman fares nor to excess fares charged for passage on certain trains. Local railroad ticket agents will supply detailed information with regard to rates, routes, etc. Stop-overs on both the going and return journeys may be had within certain limits.

Full fare must be paid from starting point to Philadelphia and it is essential that a convenient certificate be obtained from the agent from whom the ticket is purchased. These certificates to be signed by the general manager of the Clinical Congress and vised by a special agent of the railroads in Philadelphia during the meeting. A reduction in railroad fares can be secured except in compliance with the regulations outlined and within the dates specified. It is important to note that the return trip must be made by the same route as used to Philadelphia and that

the certificate must be presented and return ticket purchased not later than November 3

#### LIMITED ATTENDANCE

Attendance at the Philadelphia session will be limited to a number that can be comfortably accommodated at the clinics the limit of attendance being based upon the result of a survey of the amphitheaters operating rooms and laboratories in the hospital and medical schools as to their capacity for accommodating visitors This plan necessitates registration in advance on the part of all who wish to attend When the limit of attendance has been reached through advance registration no further applications can be accepted

Attendance at clinics and demonstrations will be controlled by means of special clinic tickets which plan has proved an efficient means in the

past for providing for the distribution of visiting surgeons among the several clinics and insures against overcrowding as the number of tickets issued for any clinic is limited to the capacity of the room in which that clinic is given

#### REGISTRATION FEE

A registration fee of \$5.00 is required of each surgeon attending the annual clinical meeting such fees providing the funds with which to meet the expenses of the meeting To each surgeon registering in advance a formal receipt for the registration fee is issued which receipt is to be exchanged for a general admission card upon his registration at headquarters during the meeting This card which is nontransferable must be presented to secure clinic tickets and admission to the evening meetings

### PHILADELPHIA HOTELS AND THEIR RATES

	Minimum Room Single	Maximum Room with Bath Double
Adelphi Ch. st. and 4th Sts	\$4.00	\$8.00
Bellvue Stratford Brod and Walnut Sts	5.00	8.00
Benjamin Franklin Chestnut and 9th Sts	3.00	6.00
Greens 8th and Chestnut Sts	3.50	5.00
Logan Walnut St West of Broad	4.00	6.00
Lorraine Broad St and Fairmont Ave	5.00	5.00
West Chester Broad St and Grand Ave	4.00	5.00
Robert Morris 7th and Arch and the Parkway	3.00	5.00
Pennsylvania Chestnut and 39th Sts	3.00	6.00
Rittenberg Chestnut and 10th Sts	3.50	5.00
Ritz Carlton Broad and Walnut Sts	6.00	10.00
Spruce (men only) Spruce and 13th Sts	4.00	
St James Walnut and 3th Sts	3.50	5.00
Stent Broad and Spruce Sts	5.00	7.00
Sylvania Locust and 7th Sts	4.00	6.00
Walt Broad and Locust Sts	3.00	5.00



## PRELIMINARY PROGRAM FOR EVENING MEETINGS

IN THE BALLROOM OF THE BELLEVUE STRATFORD AT 8 O'CLOCK

*Presidential Meeting—Monday October 26*

Address of Welcome CHARLES F NASSAU M D Chairman of Committee on Arrangements

Address of Retiring President CHARLES H MAYO M D Rochester Minnesota

Introduction of Foreign Guests

Inaugural Address RUDOLPH MATAS M D New Orleans

The Doctor John B Murphy Oration in Surgery SIR WILLIAM ARBUTHNOT LAKE Bt London England

*Tuesday Wednesday and Thursday October 27 28 and 29*

PROFESSOR VITTORIO PUTTI Bologna Italy Cong nital Dislocation of th Hip

Discussion DEFOREST P WILLARD M D Philadelphia

W BLAIR BELL BS M D Liverpool England The Treatment of Chronic Ascending Infections of the Uterus and Adnexa by the Bell Beuttner Operation with Ovarian Conservation or Grafting

Discussion JOHN C CLARK M D and BROOKE M ANSPACH M D Philadelphia

ARTHUR H CURTIS M D Chicago Chronic Pelvic Infections Deductions Resultant from a Combined Clinical and Laboratory Study

ROBERT C COFFEY M D Portland Oregon The Principles of the Radical Treatment of Cancer of the Organs Located in the Pelvis

Discussion JOHN B DEEVER M D and GEORGE P MULLER M D Philadelphia

Symposium on the Rehabilitation of the Hand capped Patient

A. MURAT WILLIS M D Richmond Virginia The Mortality in Important Surgical Diseases Especially Appendicitis

Discussion DAMON B PFEIFFER M D and JOHN STEWART RODMAN M D Philadelphia

CHEVALIER JACKSON M D Philadelphia Chalk Talk

*Convocation—Friday October 30*

Invocation

Conferring of Honorary Fellowships

Presentation of Candidates for Fellowship

Presidential Address RUDOLPH MATAS M D New Orleans

Fellowship Address THE RIGHT HON LORD DAWSON OF PENN G C V O CB London England Physician in Ordinary to H M The King

## HOSPITAL STANDARDIZATION CONFERENCE

IN THE BALLROOM OF THE BELLEVUE STRATFORD

*Monday October 26—Morning Session 10 00 to 12 30*

CHARLES H MAYO M D Rochester President Presiding

Opening Address by the President

Presentation of the Eighth Annual Report of Hospital Standardization FRANKLIN H MARTIN M D  
Chicago Director General American College of SurgeonsThe Responsibility of the Fellows of the American College of Surgeons in Hospital Standardization LEROY  
LONG M D Oklahoma City Okla Dean and Professor of Surgery University of Oklahoma School of  
MedicineThe Hospital the Doctor and the Nurse as Co-operating Factors in the Care of the Patient W T HENDER  
SON M D Mobile Ala Visiting Surgeon Providence Infirmary and Mobile City Hospital

The Eminent Hospital REV C B MOULINIER S J Milwaukee President Catholic Hospital Association

What the American College of Surgeons Can Do for the Smaller Hospital PAUL H FESLER Oklahoma  
City Okla Superintendent State University HospitalHospital Efficiency from the Viewpoint of the Internist ALFRED T STENGEL M D Philadelphia Pro  
fessor of Medicine University of Pennsylvania President American College of PhysiciansPolitical Interference in Hospitals RUDOLPH MATAS M D New Orleans Professor of Surgery Tulane  
University of Louisiana School of Medicine President Elect American College of Surgeons*Afternoon Session 00 to 5 00*The Hospital of the Future NEWTON E DAVIS Chicago President American Protestant Hospital Asso  
ciation Corresponding Secretary Board of Hospitals Homes and Deaconess Work of the Methodist  
Episcopal ChurchThe Application of American College of Surgeons Standards in the Modern Hospital H L FOSS M D  
Danville Pa Surgeon in Chief Geisinger Memorial HospitalEssentials for an Efficient Fracture Service in a Hospital CHARLES L SCUDDER M D Boston Consulting  
Surgeon Massachusetts General HospitalEnd Results and Follow Up HENRY L PAGE M D Philadelphia Medical Director Lankenau Hospital  
and Miss ANNIE M JASTROW Philadelphia Record Librarian Lankenau Hospital

Post Mortems in Hospital

Findings in the State of Pennsylvania Survey FRANK C HAMMOND M D Philadelphia Dean and  
Professor of Gynecology Temple University Department of MedicineRelation of the Surgeon to Post Mortems CHARLES BACLEY JR M D Baltimore Associate in Ex  
periment in Neurology John Hopkins University Medical DepartmentPost Mortems in the Open Hospital ISRAEL BROWN M D Norfolk Va Surgeon St Vincent's Hos  
pital and Sanitarium

General discussion

*Tuesday October 27—Morning Session 10 00 to 12 30*Group Conference on Medical Service in Hospitals—Ophthalmology and Oto Laryngology JAMES A  
BABBITT M D Philadelphia Associate Professor of Oto Laryngology University of Pennsylvania  
Graduate School of Medicine presiding A complete program for this conference will be published in  
the next issue*Afternoon Session 2 00 to 5 00*The Role of the Medical Staff in Hospital Efficiency J GARLAND SHERRILL M D Louisville Professor of  
Surgery University of Louisville Medical Department

**Round Table Conference** Conducted by JOSEPH C. DOANE, M.D., Philadelphia, Medical Director and Superintendent, Philadelphia General Hospital. Topics for discussion: The relation and responsibility of the hospital administration in pre-operative preparatory procedures; the relations and responsibilities of the interne; the best methods of making more efficient the instruction and experience of the internes and nurses in the surgical department; responsibility of the surgeon in promoting economies in the surgical department; the most efficient arrangement of concurrent staff services in relation to duty; the essentials for an efficient anæsthesia department; supervision and control of the surgical department; the Open Hospital policy; the best means for handling extra charges for special services; the education of new trustees in regard to the hospital and its workings.

**General discussion**

*Wednesday, October 8—Morning Session: 10:00 to 12:30*

**Group Conference on Medical Service in Hospitals—Internal Medicine** ALFRED T. STENGEL, M.D., Philadelphia, Professor of Medicine, University of Pennsylvania; President, American College of Physicians presiding. A complete program for this conference will be published in the next issue.

*Afternoon Session— 1:00 to 5:00*

**Systematic Collection and Official Publication of Operative Mortalities as a Means of Fostering Surgical Accountancy** ROBERT L. DICKINSON, M.D., New York, Senior Gynecologist and Obstetrician, Brooklyn Hospital.

**Round Table Conference** Conducted by JOHN D. SPELMAN, M.D., New Orleans, Superintendent, Touro Infirmary. Topics for discussion: A plan of procedure in selecting members of the medical staff and extending privileges to doctors to practice therein; the ownership of the case record; the best means of improving the quality of case records; the relation of medical staff to board of trustees; the hospital and the private duty nurse; the relative advantages and disadvantages of continuous versus divided ward services in a hospital; dental service in hospitals; isolation, segregation and observation accommodations in all hospitals; the problem of the tuberculous patient in the general hospital; physiotherapy in hospital.

**General discussion**

# GENERAL SURGERY GYNECOLOGY OBSTETRICS ORTHOPEDICS UROLOGY

## UNIVERSITY HOSPITAL

Tuesday

JOHN G. CLARK, C. C. NORRIS and F. E. KEENE—9  
Gynecology  
C. H. FRAZIER, F. GRANT and TEMPLE FAY—9 Neuro-  
surgery  
B. C. HIRST, E. B. PIPER, J. C. HIRST II, J. K. JAFFE  
G. V. JANVIER and W. B. HARER—9 Obstetrics  
and gynecology  
GEORGE I. MULLER and I. S. RAVDEN—9 General surgery  
A. BRUCE GILL—9 Orthopedics  
CHEVALIER JACKSON and GABRIEL TUCKER—3 Bronchus  
copy

Wednesday

JOHN G. CLARK, C. C. NORRIS and F. E. KEENE—9  
Gynecology  
E. L. ELIASON and DRURY HINTON—9 General surgery  
A. RANDALL, S. W. MOORHEAD, P. S. PELOUZE and  
MAURICE MISCHKE—2 Urology

Thursday

JOHN G. CLARK, C. C. NORRIS and F. E. KEENE—9  
Gynecology  
C. H. FRAZIER, F. GRANT and TEMPLE FAY—9 Neuro-  
surgery  
B. C. HIRST, E. B. PIPER, J. C. HIRST II, J. K. JAFFE  
G. V. JANVIER and W. B. HARER—9 Obstetrics and  
gynecology  
G. P. MULLER, I. S. RAVDEN—9 General surgery  
A. BRUCE GILL—9 Orthopedics  
CHEVALIER JACKSON and GABRIEL TUCKER—3 Bronchus  
copy

Friday

JOHN G. CLARK, C. C. NORRIS and F. E. KEENE—9  
Gynecology  
C. H. FRAZIER, F. GRANT and TEMPLE FAY—9 Uro-  
surgery  
B. C. HIRST, E. B. PIPER, J. C. HIRST II, J. K. JAFFE  
G. V. JANVIER and W. B. HARER—9 Gynecology and  
obstetrics  
E. L. ELIASON and DRURY HINTON—9 General surgery  
A. BRUCE GILL—9 Orthopedics

## MISERICORDIA HOSPITAL

Tuesday

BASIL BELTRAN and staff—9 General surgery  
JAMES A. KELLY and staff—9 General surgery

Wednesday

GEORGE P. MULLER and THOMAS RYAN—9 General  
surgery  
PETER M. KLATING—9 Clinical demonstration  
J. F. A. JONES—9 General surgery

Thursday

BASIL BELTRAN and staff—9 General surgery  
JAMES A. KELLY and staff—9 General surgery

Friday

GEORGE P. MULLER and THOMAS RYAN—9 General  
surgery  
PETER M. KLATING—9 Clinical demonstration  
J. F. A. JONES—9 General surgery

## JEFFERSON HOSPITAL

Tuesday

J. TORRANCE RICH—9 30 Orthopedic  
CHARLES F. VASSAU—1 General surgery  
THOMAS C. STELLWAGEN—11 Genito-urinary surgery  
JOHN H. GIBBON—General surgery

Wednesday

CHEVALIER JACKSON—9 Bronchoscopic pyrolytic diagnosis and  
treatment of diseases of the lungs  
BROOKE M. ANSPACH and staff—9 Gynecology  
P. BROOKE BLAND—9 Gynecology  
W. H. KINNEY—9 Genito-urinary surgery  
JOHN B. FLICK—11 General surgery  
J. CHALMERS D'ARCY—2 Surgical clinic

Thursday

H. R. LOUG—9 Genito-urinary surgery  
J. M. FISHER—11 Gynecology  
THOMAS A. SHALLON—1 General surgery  
ARTHUR DAVIDSON—11 Orthopedic surgery  
CHEVALIER JACKSON, GABRIEL TUCKER and LOUIS CLERY  
—23 Bronchoscopic aspiration in suppuration  
diseases of the lung

Friday

EDWARD J. KLOPP—11 General surgery

## HOWARD HOSPITAL

Tuesday

A. C. WOOD—9 General surgery  
E. L. ELIASON, DRURY HINTON and V. W. M. WRIGHT—  
9 30 General surgery, Industrial surgery clinic  
Outline of system of records follow-up Routine  
surgery

Wednesday

B. C. HIRST—9 Gynecology

Thursday

A. C. WOOD—9 General surgery  
E. L. ELIASON, DRURY HINTON and V. W. M. WRIGHT—  
30 Fracture clinic methods and results  
E. L. ELIASON—11 Routine surgery, ulcer loculations  
thromboses  
S. W. MOORHEAD—4 Genito-urinary clinic

Friday

B. C. HIRST—9 Gynecology

## PRESBYTERIAN HOSPITAL

J. H. JOHNSON, JOHN SPEISE, D. B. PREIFFER, J. S. ROD-  
MAN and HENRY F. BROOKS, JR.—9 General surgery  
JOHN H. GIBBON, GEORGE M. LAWS and PHILIP WILLIAMS  
Gynecology

B. A. THOMAS and staff—9 Genito-urinary surgery  
A. BRUCE GILL and T. C. ORR—9 Orthopedic surgery  
FRANK CROZER KNOWLES and HENRY G. MCNOSH  
Dermatology

JOHN A. EDMAN and W. EDGAR CHRISTIE, JOHN H. GIBBON,  
and staff—9 General surgery and F. G. HARRISON—9 Surgi-  
cal department

WILLIAM S. NEWCOMB—9 Roentgenology  
Operative clinics daily at 9 Demonstrations and patho-  
logical exhibits in new outpatient department building at 23

## LANCASHIRE HOSPITAL

T day

STANLEY P REIMAN—9 Demonstration in new laboratory

A G MILLER and ROBERT SHOEMAKER—11 Demonstration in roentgenology

F L HARTMAN—11 Demonstration of follow-up system

Wed day

STANLEY P REIMAN—9 Demonstration in new laboratory

F L HARTMAN—11 Demonstration of follow-up system

A G MILLER and ROBERT SHOEMAKER—11 Demonstration in roentgenology

JOHN B DEEVER—11 General surgery

Th day

F L HARTMAN—11 Demonstration of follow-up system

A G MILLER and ROBERT SHOEMAKER—11 Demonstration in roentgenology

JOHN B DEEVER—11 General surgery

WILLIAM H MACKEY—5 Gynecology

F day

STANLEY P REIMAN—9 Demonstration in new laboratory

A G MILLER and ROBERT SHOEMAKER—11 Demonstration in roentgenology

F L HARTMAN—11 Demonstration of follow-up system

## CHILDREN'S HOSPITAL

Tu day

J H JORDAN—9 Diagnosis in surgical diseases of the abdomen

J C GIBBINGS—9 Some medical aspects of surgery

C W BURN and F L LEAVITT—9 Neurological problems in children

C C NORRIS—9 Variations in infants and young children methods of treatment.

Wed day

W ESTELL LEE and J R WELLS—9 Problems in the surgery

R S BROMER—9 X-ray in the radio and gastro-intestinal

Th day

HOWARD C CARPENTER—9 Health examination in children

EMILY I BROWN—9 Demonstration of nutritional in children

SUSAN C FRANCHIS—9 Tuberculosis in children

Fr day

JOHN SPEESE and W EDGAR CHRISTIE—9 Postoperative management of surgical cases

HENRY L BROW and ERNEST G WILLIAMS—9 Management of the surgical out-patient department

## WOMAN'S COLLEGE HOSPITAL

T day

LEDA STEWART COGILL—9 Prenatal clinic

Wed day

J S RODMAN—9 General surgery

Th day

CATHARINE M CARLANE—9 Gynecology

F day

J S RODMAN—9 General surgery

## ST JOSEPH'S HOSPITAL

Tu day

JOSEPH M SPILLISSY—9 Dry clinic. Operative mechanical treatment of some of the effects of influenza

JOHN J JONES—9 General surgery peritonectomy

gall bladder disease

Wed day

MELVIN M FRANKLIN—9 General surgery influence of prosthesis upon amputations chronic tuberculosis suppuration in bone

F HURST MAIER—11 Gynecology hysterectomy for myofibromatosis placental proctodentia suspicion for retroflexion

Th day

JAMES J KELLY—9 General surgery fracture of

F day

CHARLES F NASS—9 General surgery bilateral thyroidectomy myofibromatosis hernia operation and local anesthesia

F BROOKE BLAINE—9 Gynecology placenta previa for uterine myofibromatosis bilateral hysterectomy peritonectomy

## PHILADELPHIA GENERAL HOSPITAL

T day

FRANK C HAMMOND—10 Veneral surgical operation

WILLIAM H MC KINNEY—9 Genito-urinary operations

Wed day

ALFRED C WOOD—9 General surgery

J T RICH—11 Orthopedic surgery

STAFF—9 Symptom in cancer of the breast

Surgery: HEAVY H. LANCET, ST. R. L. G. C. C.

NORRIS GYNCELOGY J F SCHAMBERG, dermatology

ROBERT G. TORRELL medical GEORGE M. DORRANCE

fracture maxillary J O LEVINS radiology A. T. T.

radiation m. nat. n. plant. d. ep. th. rap. l. bora

t. nes

Th day

J B. CAR. TIT. J. RALSTO. WELLS R. BERT BRADLEY and

JAMES I. WEATHERWAX—9 Non-operative cancer

EDWARD A. SCHULMANN—9 Gynecological operations

F day

T. T. THOMAS—9 General surgery

C. C. N. R. S.—9 Gynecological clinic c. c. r. perat

EDWARD B. ARTHUR and A. d. tall. f. path. l. g. ts—4

Clinical path. log. c. l. onferen. d. m. strating cu

nt. interesting path. logical c. nd. t. s. nd. spec. m. ns.

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## NORTHEASTERN HOSPITAL

Wed day

J. Z. HERSHMAN—9 Anorectal infection

T. T. THOMAS—9 O. C. r. surgery

JOHN B. LOWNES and J. A. BROADFIELD—9 Operative

cystoscopy clinic

Th day

T. TURNER THOMAS—9 Dry clinic. Re. lts. with non

perat. ve. red. ct. n. especially of wrist elbow sho. l.

der. h. p. and. ankl. Operat. cre. d. ctio. C. m. pound

fract. r. s. R. urrent. d. locat. s. d. of. shoul. r. Bra

ch. lb. rth. p. l. sy

## METHODIST EPISCOPAL HOSPITAL

Tuesday

- JAMES H. BALDWIN—9 Gas gangrene foreign body in bladder fractures of patella foreign body in brain  
 MILTON F. PERCIVAL—9 Daily demonstrations of X-ray technique fluoroscopy pyelograms electrocoagulation diathermy and photography

Wednesday

- WILLIAM R. NICHOLSON—9 Vesicoaginal fistula cystocele prolapse of uterus cervical repairs and repairs of perineum  
 LEVI JAY HARMON—2 Surgery of ligaments stomach spleen and pancreas

Thursday

- DAMON B. PFEIFFER—9 Carcinoma of the rectosigmoid blood transfusion surgery of the gall bladder stomach and intestines  
 RICHARD C. NORRIS—2 Abdominal gynecology retroversion uterine and ovarian tumors caesarean section

Friday

- J. T. RUGH—9 Atherosclerosis of the pelvic deformities tabularization of the hip joint and spinal bone grafts  
 LEON HERMAN—1 Prostatectomy renal calculus hypernephroma ligament tumors of the bladder cystoscopy and pyelography

## MT SINAI HOSPITAL

Tuesday

- CHARLES F. NASSAU—9 Radical cure of hernia local anesthesia  
 G. ROSENBAUM—2 X-rays of gastrointestinal tract

Wednesday

- M. BEI REND—9 Surgery of the passage and growth of intestinal tract. Presentation of cases  
 M. COOPERMAN—2 Gonorrhea arthritis dislocation of hip astraglectomy Whitman reconstruction operation  
 G. TUCKER—4 Bronchoscopy and esophagoscopy

Thursday

- J. C. HIRST—9 Prolapse of uterus cystoscopy aginal repair  
 G. ROSENBAUM—1 X-rays of gastrointestinal tract  
 G. TUCKER—4 Bronchoscopy and esophagoscopy

Friday

- C. MAZER—9 Plastic rubber test and pyelography  
 C. HIRST—1 Gonorrhea demonstration of cases

## COOPER HOSPITAL (Camd.)

Tuesday

- THOMAS B. LEE ALBERT B. DAVIS and GORDON WEST—9 Gynecology

Wednesday

- PAUL M. MCCRAY and Associates—10 General surgery  
 A. HAINES LIPPI COST and DAVID B. ATLEY JR.—30 Genito-urinary and rectal clinic  
 B. F. BUZBY—30 Orthopedic clinic

Thursday

- THOMAS B. LEE ALBERT B. DAVIS and GORDON WEST—9 Gynecology

Friday

- PAUL M. MCCRAY and Associates—10 General surgery  
 B. F. BUZBY—23 Orthopedics

## STETSON HOSPITAL

Tuesday

- JOHN A. BOGER and WILLIAM T. ELLIS—1 General surgery hernia appendectomy cholecystectomy reduction of fracture

Wednesday

- S. E. TRACY and Associates—9 Gynecological clinic  
 Plastic operations trachelorrhaphy trachelectomy anterior colporrhaphy pelvicorrhaphy myomectomy and hysterectomy for fibroids shortening of the round ligaments conservative operations for pelvic inflammatory conditions

Thursday

- BROOKE M. ANSPACH and Associates—9 Gynecological clinic

Friday

- S. E. TRACY and Associates—9 Gynecological clinic  
 CARL F. KOENIG—1 Roentgenology Diagnostic and deep therapy clinic

## WOMAN'S HOSPITAL

Tuesday

- SARAH H. LOCAREY and EMILY WHITTEN AUGER—9 Gynecology  
 LIDA STEWART COGILL and ELIZABETH HUGHES—2 Obstetrics  
 JULIA HARDIN—Gas-oxygen and ethylene anesthesia

Wednesday

- MARIE A. FORMAN and ALBERTA FELTZ—9 Gynecology  
 ELLA WILLIAMS GRIM and ALBERTA FELTZ—3 Obstetrics  
 JULIA HARDIN—Gas-oxygen and ethylene anesthesia

Thursday

- CATHARINE MACFARLANE and FAITH S. FETTERMAN—9 Gynecology  
 MARY LEWIS and DELLA MILDADIAS—3 Obstetrics  
 JULIA HARDIN—Gas-oxygen and ethylene anesthesia

Friday

- KATE W. BALDWIN—9 General surgery  
 ELIZABETH F. C. CLARK—1 Gynecology  
 ANN TOMKINS GIBSON and JESSIE W. PRYOR—2 Obstetrics  
 EMILY WHITE AUGER—3 General surgery  
 JULIA HARDIN—Gas-oxygen and ethylene anesthesia

## ST. LUKE'S HOSPITAL

Tuesday

- DESIDERIO ROMAN—9 General surgery  
 O. F. HARTHMAIER—11 Demonstration of blood transfusion

Wednesday

- A. B. WEBSTER—9 General surgery  
 J. WALTER POST—1 Demonstration of roentgenology  
 WILLIAM C. HUNSICKER and J. MILLER KENWORTHY—2 Genito-urinary surgery and cystoscopy

Thursday

- DESIDERIO ROMAN—9 Operations upon thyroid and demonstration of group study of thyroid disease

Friday

- A. B. WEBSTER—9 General surgery  
 J. WALTER POST—1 Demonstration in roentgenology  
 WILLIAM C. HUNSICKER and J. MILLER KENWORTHY—2 Genito-urinary surgery and cystoscopy

## HAHNEMANN HOSPITAL

T day

- I T ASHCRAFT WILLIAM C Ill SICKER FRA K C  
Benson Jr—9 Urologic clinic Symposium on  
t mors of th urinary blid r and on arc ma of th  
prostate Demon tr tion of local an sties
- J E JAMES, JR a d LEON CLEMMER—10 Ob tetric l  
cl i S h nt points in pel mery The rll of  
ers n in bsteirical s rg ry Cervic abd min l  
hysterect my
- F W SMITH—2 Bron l sc j c rk th e l er
- F C Br son Jr—3 R d um cl c Techniq e of ap-  
ple c tion and result in uperic l malgna t tumors  
Limit to c ntra ind cation and la pers nral m  
th rapy

H d sdy

- H L NORTHRUP—9 Th ra c surger
- D B JAMES a J L CRAIG—9 Gynec l gical clinic  
M g nity of th ut ru
- W C MERCER and J B BERT—9 Obstet cal cl c  
Forceps appl cation with spec l f rrenc to the  
cejal c appl cation in poster r obl juc positions  
The mech l m of labor
- S W SAPPINGTON—3 D monstrat n of an usm thods  
of blood transfusion

Th sdy

- J D ELLIOTT and WILLIAM M SYLVIS—9 Operati e  
cl c Turs of the bre t D yuss n of the pa  
thology and e d results f treatment by X rays ra  
dum a d oper ti n
- D B JAMES—9 Gynec log l cl c
- O B WAITE and N J LAXSO—10 Ob tetr c l cl n c  
l n tal c re Practi al results f routin W aser  
m nnt ts Pr eclampsia and eclampsia. Fetal mor  
tality
- J A BROOKE—9 Orthopedic cl c Shorte g of bones  
f tle l g to c rect l equal ty in l gth Demonstra  
tion f new bone skid k lts of a trag lectomy in  
paralytic foot
- J W IRANK—9 Roentg log clun C mparison of  
n e r fms l roentg n t tm t f r lgn ncy  
th f rmer methods Presentat n f p tents

F day

- G A VAN EYENBER d H I L OPOLD—9 S rg ry of the  
t m ch l duodenum
- N F LANE a d D W COLL—9 Uteri ebl dng d g  
n s d t tm t

## ST AGNES HOSPITAL

Tu sdy

- L C MURPHY—9 Dry cl i l l l l l l f fract re  
ca sw th nd result l p e at e l non operati  
proc l res
- JOHN V J NES—9 C r l r l c y pe at e c  
Jot v l Med tr v—9 Gynec l gy F h b l n f p tents  
f tcl f te l mat ry d es l y n ns f  
n p e f l ot s D m strat of m thod f  
tre timent f g no l oca th f m l l h t

Wed sdy

- G M DO RANCE and J W BR SPIEL—9 Op rati e  
thnic and d m nst at n f ases Clef t l t cases  
p rated by th n w m thod f gati f p l te
- JOHN M F SIER—9 Gynec l gy
- WILBUR B HAINES—9 G n t n s r g ry
- J C HIRST and tall—9 C c l gy d b lctn s

## SAMARITAN HOSPITAL

Tu day

- JOHN LEEDON J O BOYER G MASON ASTLEY JOHN C  
FRICK a J J V COOM s—9 S rg cal clur
- HARRY HUDSON—2 O th spedic lin
- ALBERT STRICKLER—3 Dermat logy

H d sdy

- W WAYNE BARCOCK—9 Ge ral surgery
- CHARLES S HAINES a d C M SIMMONS—11 Obstetrics
- FRANK C HAMMOND—9 Gynecology
- W HENRY TY MIS—4 Ge nro-urinary surg ry
- HARRY L HIR HMA—5 Rectal clinic

Ths day

- A C APPELGATE—1 Obstet ics.

Fnd y

- W WAYNE BARCOCK—9 Ge rals rg ry

## IRANKFORD HOSPITAL

Wed day

- W E P RKE—9 30 Plast c plastic nd ctroversy of  
ut rus
- E A SCHUMANN—9 31 Bro d of uterus c reanom of  
ut rus plasti c a d secti n
- C C HANNA—9 30 Cavaia secti n
- F F KELL R—9 3 Cars ti n secti local naesthesia

Ths day

- CHARLES A SSO—9 30 Chol l thias d od natulcer  
n phrolith ass g t r
- LOUIS D ENGERLH—9 30 Hern und rlocalanesthesia  
tract re clin

## POLYCLINIC HOSPITAL

Tu sdy

- DEFOREST I WILLARD—10 30 Orth ped cs.
- C I FAYL R—9 R d log conf cence
- B A THOMAS—9 Urol gy

Wed sdy

- I H IVY nd LAWRENCE CLERTY—9 Orals rg ry
- W G ILM R—9 3 O th ped s rgery

Ths day

- COUSER F MARTIN—9 Proct logy
- J F SCHAMBERG—9 Arphenamin clin c

Friday

- R H IVY—9 M ill fac l surg ry
- B A THOM—9 1 Urol gy
- L A C SE—9 1 r gic l pth l gy

## AMERICAN ONCOLOGIC HOSPITAL

T e d

- W S NEWCO T—9 Cas s f ng ma treated and  
und r t timent lect d from gro p f 200
- SAMUEL MCCLAR J d—9 C ses of of th l p d  
m th

## ST CHRISTOPHER'S HOSPITAL

- E G ALEX. p 2—9 S r l l l n H r w appe dix  
pyl n st undescend d t l l harel p  
m p y m d bon ases Surgers in h ldren.

## ST MARY'S HOSPITAL

Tuesday

JAMES A KELLY—9 General surgery  
 WILLIAM J RYAN—9 General surgery  
 WILBUR H HAINES and L F MILLIKEN—2 Genito  
 urinary clinic  
 W T REES Laboratory demonstration

Wednesday

WILLIAM A STEEL—9 Abdominal surgery with spinal  
 anaesthesia  
 A P KEEGAN—9 General surgery and local anaesthesia  
 C HOWARD MOORE—9 Thoracic and clinic operations and  
 demonstration of cases  
 W T REES Laboratory demonstration

Thursday

FRANK D HARRIS—9 Gynecology  
 WILLIAM F MORRISON—9 Gynecology  
 WILLIAM E PARKE and J STUART LAWRENCE—1 30  
 Obstetrical clinic in labor room and ward walk Oper  
 ative P natal clinic  
 W T REES Laboratory demonstration

## JEWISH HOSPITAL

Tuesday

M BEHRND—9 General surgery  
 W H TELLER—2 General surgery

Wednesday

F B BLOCK—9 General surgery  
 L BELLMAN—9 General surgery

Thursday

M BEHRND—9 General surgery  
 F B BLOCK—2 General surgery

Friday

L BELLMAN—9 General surgery  
 W H TELLER—2 General surgery

## PENNSYLVANIA HOSPITAL

Tuesday

CHARLES F MITCHELL, W ESTELL LEE, HENRY P  
 BROWN and LEON HERMAN—1 General surgery

Wednesday

JOHN H GIBSON, ARTHUR E BILLINGS, EDWARD J KLOPF  
 JOHN B FLICK and LEON HERMAN—General  
 surgery

Thursday

JAMES CAMERON—9 Oral surgery  
 J R PAUL—9 Surgical pathology  
 CHARLES F MITCHELL, W ESTELL LEE, HENRY P BROWN  
 and LEON HERMAN—General surgery

## CHESTNUT HILL HOSPITAL

Thursday

ANDREW GODFREY and WILLIAM SHEEHAN—10 General  
 surgery  
 ALEXANDER RANDALL—Urology

Wednesday

J MURRAY ELLZEY—9 Fracture line

Thursday

J F McCLOSKEY—9 General surgery

## EPISCOPAL HOSPITAL

Tuesday

RALPH S BROMER—9 X-ray demonstration  
 LOUIS H MUTSCHLER—11 Operative clinic general  
 surgery

Wednesday

ASTLEY P C ASHHURST, IRVING M BOYKIN and EDWARD  
 T CROSSAN—9 Operative clinic general surgery  
 A BRUCE GILL, RUTHERFORD L JOHN and ALBERT F  
 MOXEY—2 Orthopedics

Thursday

F C ALEXANDER—9 Operative clinic general surgery  
 H C DAVEN—11 Operative clinic general surgery

Friday

L T CROSSAN—9 Demonstration in surgical pathology  
 L H MUTSCHLER—9 Operative clinic general surgery  
 JOHN B HAINES—9 Cystoscopic clinic

## MEDICO CHIRURGICAL HOSPITAL

Tuesday

J B CARNETT—9 General surgery  
 GEORGE M BOYD—1 Gynecology

Wednesday

GEORGE W OUTERBRIDGE—9 Cystoscopy  
 WILLIAM R NICHOLSON—9 Gynecology

Friday

J B CARNETT—9 General surgery  
 GEORGE M BOYD—9 Gynecology

## KENSINGTON HOSPITAL FOR WOMEN

Tuesday

WILLIAM E PARKE—9 Prenatal clinic history taking  
 pelvimetry blood pressure records obstetrical an  
 alysis  
 H C DE WINTER—2 30 General surgical clinic

Friday

DANIEL LONGAKER—1 Pottery version statistics and  
 demonstration of a stillborn male

## WOMEN'S HOMEOPATHIC HOSPITAL

Thursday

JOHN A BROOKE—9 Orthopedics

Wednesday

ARTHUR HARTLEY—9 General surgery

Friday

FRANCIS L HUGHES—1 Gynecology

## CHILDREN'S HOMEOPATHIC HOSPITAL

Tuesday

H P LEOPOLD—9 General surgery

Wednesday

JOHN BROOKE—2 Orthopedic clinic After results in ep  
 iphyseal fractures laboratory diagnosis of phyllopharyngeal  
 changes in the development of the bones

Thursday

A K DOERFER JR—2 Obstetrical clinic



## NORTHWESTERN GENERAL HOSPITAL

T e d y

J O ARNOLD—2 Obstetrical clinic Peritonotomy and  
improved technique

Wed s d y

J T SCHELL—9 General surgery

Th s d y

ARTHUR D KURTZ—3 30 Orthopedic dry clinic.

F s d y

ROBERT BOYER—11 C to-urinary clinic Sup public  
prostatectomy

## ORTHOPEDIC HOSPITAL

T e d a

ASTLEY P C ASHURST RUTHERFORD L JOHN EDWARD T  
CROSSAN and B F BLIZBY—1 Orthopedic mon  
stration

Th s d y

ASTLEY P C ASHURST RUTHERFORD L JOHN EDWARD T  
CROSSAN and B F BLIZBY—9 Orthopedic opera  
tions

Frid y

A BRUCE GILL, C R BOWEN and J MES E WYANT  
Orthopedic clinic.

## SURGERY OF THE EYE, EAR NOSE AND THROAT

## CLINICAL DEMONSTRATIONS AND PAPERS

Ballroom Bellvue-Stratford

Tu s d y—9 a m

Group conference on problems related to the Hospital  
St. d. reduced program applied to ophthalmologic  
and otolaryngological services

W e d s d y—9 a m

PHILIP FRANKLIN Lond England The Clinical Aspect  
of TonsilsD s c u s s i o n GEORGE B WOOD Philadelphia C W  
RICHARDS Washington C C COAKLEY New YorkCREVALIER JACKSON Phil d lphia Laryngoscopy for  
Cancer of the LarynxD s c u s s i o n H RMO SMITH New York H W LOEB  
St Louis LOUIS H CLIFF PhiladelphiaHARRY S CRADLE Chicago The Fracture of the Stomach  
Lamp in Daily RoutineD s c u s s i o n H C TIER H McQUIR Winchester Va  
ALFRED COWAN Phil d lphia LUTHER C PETER  
Phil d lphiaDOUGLAS QUICK New York Use of Palium and X-ray in  
the Treatment of Malignant Disease of the Paranasal  
SinusesD s c u s s i o n D CROSBY CREVE Boston CHARLES  
I LANCASTER Phil d lphia C F FRAWLER  
Phil d lphiaJ H L MCKENNEY New York Laryngotomy in On  
Stomach Cancers on One Hundred Operations

D s c u s s i o n F LIDIN O LEWIS Philadelphia

Th s d y—9 a m

F L A R E S T WHITNALL Montreal Canada Trepan  
CapitulumJ C BECK Chicago Some of the Important Complica  
tions of the Ear, Nose and Throat Diseases and Opera  
tions and the ManagementD s c u s s i o n C O R E M COATES Philadelphia  
RALPH BUTLER PhiladelphiaE C FLETT Memphis Tennessee The Use of the Suture  
in Cataract ExtractionD s c u s s i o n LEWIS ZIGLER Philadelphia WILLIAM  
ZENTHVER PhiladelphiaV L L S P LAGLETO New York Menigelectomy  
of the OccipitalD s c u s s i o n S MACCORMACK SMITH Phil d lphia  
JAMES A BARRITT Phil d lphia H I LILL  
Rochester New York

T E CARMODY Denver Observations of Children's

Senses in Health and Disease

D s c u s s i o n ROSS H SKILLERN Philadelphia LEON  
E. WHITE Phil d lphia

Frid y—9 a m

MAJOR EDMUND B SPAFFIN Takoma Park Md. Ophthal  
mic flashlight surgery Lantern slide demonstrationGEORGE M DORRCE Philadelphia Rhinoplasty presen  
tation of cases and lantern slide demonstrationWARREN H DAVIS Philadelphia Some Types of Harelip  
and Cleft Palate Defects and Their Operative  
Results Presentation of patients and lantern slide  
demonstrationCHARLES I NASSAR Philadelphia Closure of Laryn  
geal fistulae Lantern slide and map picture  
demonstration

## WILLS EYE HOSPITAL

T s d y

BURTON CHANCEY JR and C PARKER LEIGHTON F AP  
PLEMAN and BENJAMIN F BAER JR—2 Ophthalmic  
operations

W e d s d y

WILLIAM ZENTHVER PAUL J PONTIUS J MILTON GRIS  
COM and THOMAS A O'BRIEN—2 Ophthalmic  
operations

Th s d y

BURTON CHANCEY JR and C PARKER LEIGHTON F AP  
PLEMAN and BENJAMIN F BAER JR—2 Ophthalmic  
operations

Frid y

WILLIAM ZENTHVER PAUL J PONTIUS J MILTON GRIS  
COM and THOMAS A O'BRIEN—2 Ophthalmic  
operations

## MEDICO CHIRURGICAL HOSPITAL

T s d y

GEORGE M CATES—2 Otolaryngology

W e d s d y

ROSS H SKILLERN—Laryngology

Th s d y

GEORGE M CATES—Otolaryngology

Frid y

ROSS H SKILLERN—Laryngology

## EPISCOPAL HOSPITAL

T day

W R WATSON EDWARD W COLLINS and OTTY C HIRST  
—2 OtolaryngologyH F LOU C GOLDBERG DAVID J BOONE and WILLIAM H  
CHURCHILL—2 Ophthalmology

Wed day

A C LEWELL WARREN S REESE J B RUTOLIFY and  
J B HERBERT JR—2 Ophthalmology

W H WATSON and Associates—2 Otolaryngology

Th day

FREDERICK KRAUSS and J B FELDMAN—2 Ophthalmology

CHARLES C BIEDERT THOMAS R CURRIE and WILLIAM  
MATTHEWS—2 Otolaryngology

F day

CHARLES C BIEDERT and Associates—2 Otolaryngology  
HAROLD C GOLDBERG and Associates—Ophthalmology

## ST JOSEPH'S HOSPITAL

T day

C E M MERRILL—2 Otolaryngology otoscopic  
examination of the nasal fossae and maxillary  
operationEUGENE J JONES—Ophthalmology enucleation of the  
eyeball

Wed day

CHAS J JONES—Ophthalmology preliminary  
operation for retinal detachmentWILLIAM J QUINN—Otolaryngology tonsillectomy  
and adenoidectomy

Th day

THOMAS A O'BRIEN—Ophthalmology combined  
strabismic and cataract operationARTHUR WATSON—Otolaryngology, replacement of  
larynx by tracheostomy, tracheotomy and larynx  
operation, section of the larynx by excision of the  
thyroid glandC. ALLEN T. MCCARTHY—Otolaryngology and  
extremity amputation

## UNIVERSITY HOSPITAL

Tuesday

THOMAS H. LEWIS—2 Otolaryngology  
C. E. HILL and J. A. B. MITCHELL—2 Larynx

D. H. HILL—2 Otolaryngology

Wednesday

C. E. HILL and J. A. B. MITCHELL—2 Larynx  
D. H. HILL—2 Otolaryngology

Thursday

T. B. HILL—2 Otolaryngology

Friday

T. B. HILL—2 Otolaryngology  
C. E. HILL and J. A. B. MITCHELL—2 Larynx

## CHICKEN'S HOMEOPATHIC HOSPITAL

T. B. HILL—2 Otolaryngology  
C. E. HILL and J. A. B. MITCHELL—2 Larynx

## MINERICORDIA HOSPITAL

Tuesday

JOHN F. LOFTUS—2 Otolaryngology

Wednesday

C. T. MCCARTHY—2 Otolaryngology

HAROLD GOLDBERG—3 Ophthalmology

Thursday

JOHN F. LOFTUS—2 Otolaryngology

JOHN A. COLGAN—3 Ophthalmology

Friday

C. T. MCCARTHY—2 Otolaryngology

## HOWARD HOSPITAL

Tuesday

G. B. WOOD—2 Laryngology

Wednesday

W. C. FRY—2 Otolaryngology and otitis media operation

Thursday

C. B. WOOD—2 Laryngology

Friday

W. C. FRY—2 Otolaryngology

## ST. MARK'S HOSPITAL

T day

FRANK MURPHY—2 Larynx

Wed day

HOWARD MARK and WILLIAM I. CRAWFORD and ALBERT J.  
DEWITT—2 Otolaryngology

## MIT SINAI HOSPITAL

T day

J. J. HILL—2 Otolaryngology and otitis media operation

C. W. HILL—2 Otolaryngology and otitis media operation

Th day

S. J. CRAWFORD—2 Otolaryngology and otitis media operation

Fri day

A. W. WATSON—2 Otolaryngology and otitis media operation

## JULIENSON HOSPITAL

Th day

HILL—2 Otolaryngology

Fri day

H. W. HILL—2 Otolaryngology and otitis media operation

M. C. HILL—2 Otolaryngology and otitis media operation

M. C. HILL—2 Otolaryngology and otitis media operation

M. C. HILL—2 Otolaryngology and otitis media operation

M. C. HILL—2 Otolaryngology and otitis media operation

M. C. HILL—2 Otolaryngology and otitis media operation

M. C. HILL—2 Otolaryngology and otitis media operation

## POLYCLINIC HOSPITAL

*T d*

T B H LLOWAY—2 Ophthalmology

*Wed sday*

WALTER ROBERTS—2 Ot laryng log

L B CLIFSON—3 Ot laryng l gy

L C PETER—3 Ophthalmology

*Th d y*

GEORGE B WOOD—3 Laryngol g

RALPH BUTLER—3 Laryng l gy

## CHESTNUT HILL HOSPITAL

*W d d y*

BENJAMIN LARI HARRIS in DAYNES—2 Otol r g logs

*Th sday*

CARL WILLIAMS—2 Ophth l mol gy

## CHILDREN'S HOSPITAL

*W d d*H MAXWELL LANTON and A K KENNEDY—Oph  
th l mol gy*Th d y*

JAMES A BARBITT 1 St fl—2 Ot l r yng logs

## WOMAN'S COLLEGE HOSPITAL

*T sds*

MARGARET F BUTLER—2 Ot l r yngol gy

*Frid y*

MARY BUCHANAN—3 Ophthalmology

## JEWELL HOSPITAL

*W ds sday*

J KNIFE—3 1 eel 1

*Th d y*

S MCC SMITH and A S KATYMAN—3 O log l l n c

H M COLEMAN—4 Nos and throat clinic

## HAINESMAN HOSPITAL

*T s d y*G J PALEN—2 I sume l m to l operat n by ot log  
cal dep rtm t*Th sday*H S WEAVER 1 C B HOLMES—2 N se a d th o t  
clinic*F d y*

F O NAGLE—Fye l 1 athol gy of the e

## ST AGNES HOSPITAL

*T sday*

BENJAMIN D P RISH—Ot l r yngology

*W d s d y*

WARREN B DAVIS—Ot laryngology

GEORGE F J KELLY—2 Ophth l m l gy

## WOMAN'S HOSPITAL

*T d y*

LAURA I HUNT and MARY HITTLE—Otol r yngology

*W d d y*

MARGARET A WARLOW—2 3 Ot lary g logs

MARY BUCHANAN—2 Ophth l m l gy

*Th s d y*MARGARET I BUTLER and LOUISIANA LOO—Ot laryn  
gology

## COOPER HOSPITAL (Camden)

*T d y*I B HIRST F K HIRST and ALFRED ELL—2 3  
Otol r yng l gy*Th d y*I B HIRST F R HIRST and ALFRED FLEMING—2 30  
Otolaryng logs

## FRANKFORD HOSPITAL

*Th sday*

FRAN FURLEY—2 3 T l m d mast d cl 1

W J WATSON—2 3 T sil clinic

## PKE BYTERIAN HOSPITAL

H MAXWELL LANTON and Staff Ophthalmology

V I STALLER and Staff Otolaryngology

## NORTHEASTERN HOSPITAL

*Wed sday*

GEO GEY SHAFER—2 Cold ill c operation

CRANVILLE A LAWRENCE—4 Ophth l m l gy

## STITSON HOSPITAL

CARLE I FULT and A soci tes—2 Ot l r yngol gy  
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SCHOOLE B CLEASON and PHILIP S STOLT Operat e k o  
the m t d and labyr th Dem t two f th  
c d r

## WOMEN'S HOMOEOPATHIC HOSPITAL

JOSEPH F V CLAY—Thursday Ot l r yngol gy

## PHILADELPHIA CENTRAL HOSPITAL

DAVID N HEST—F d y Ot l r yng logic l operat

## SAMARITAN HOSPITAL

LUTHER C PETER—T d y 4 Ophth l m l gy





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# SURGERY, GYNECOLOGY AND OBSTETRICS

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## TERATOMATA—OVARIAN AND RETROPERITONEAL<sup>1</sup>

By ONSLOW A. GORDON, JR., M.D., F.A.C.S., BROOKLYN

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THE classification of ovarian neoplasms is at the present time a subject upon which there is a marked lack of unanimity of opinion. That this is to some degree unavoidable is apparent when one considers the multiplicity of growths both cystic and solid arising from the ovary. The need of a more uniformly accepted terminology is appreciated when we consider the question of ovarian teratomata. We find the terms teratoma, embryoma, teratoid, teratomatous dermoid and mixed cell tumor used at times interchangeably.

Lynch (15) uses the term embryoma and states that this includes dermoid and teratoma, the dermoid being essentially benign and the teratoma malignant. Bland Sutton (3) follows much the same classification considering teratomata and dermoids as specific entities. Strong (19) refers to genital and extragenital teratomata. Graves (11) considers dermoids and teratomata separately at the same time referring to a similar histogenetic origin. Ewing (6), Frank (7), Frankl (9) and others refer to ovarian teratomata as of two types: cystic and solid. The cystic is the more common, orderly arranged dermoid and the solid the unusual potpourri of tissue found in the malignant teratoma. This classification seems to me to be preferable from the standpoint of histogenesis and clarity. The common benign cystic teratoma or dermoid and the rare and

malignant solid teratoma are probably identical in origin and there are many intermediate types connecting the two. As to retroperitoneal teratomata, Kolb (12) states that no solid retroperitoneal teratoma has been reported. A careful survey of the literature to the present time substantiates this statement.

Ovarian dermoids or cystic teratomata in any location are to be carefully distinguished from true dermoids which are congenital sequestration tumors found at the lines of embryonic fusion. These tumors arise by the displacement and inclusion of ectodermal cells.

The histogenesis of ovarian teratomata is interesting but highly speculative. Any speculation as to the origin of teratomata must accept the fact that the cell from which they originate is totipotent as the growth shows evidence of all three primary germ layers: ectoderm, endoderm and mesoderm. There are at present two seriously considered theories as to their origin: one the so-called blastomere theory of Marchand and Bonnet (4) and the other the more commonly accepted germ cell theory of Wilms (21). The blastomere theory assumes that the histogenesis of these tumors dates from the earliest segmentation of the fertilized ovum for it is at this time that the blastomeres originate. In some way a blastomere becomes isolated persisting as a quiescent parasite upon its host or fetus *in situ* from the time of earliest seg-

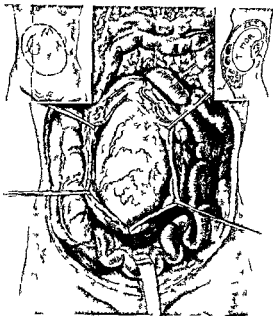


Fig 3 Retroperitoneal teratoma



Fig 4 Retroperitoneal teratoma showing the right kidney imbedded in its capsule. Specimen secured by Dr. C. H. H. H.

mentation through fetal and into postnatal life when activated by some unknown stimulus it gives rise to a teratoma. This theory readily accounts for the unusual extra ovarian teratomata found in the skull anterior mediastinum or retroperitoneal tissues. The more commonly accepted theory is that teratomata originate from germ cells whether this growth is called parthenogenetic or not is immaterial. By this explanation alone can we account for the marked predilection of teratomata for the sex glands. The multiple origin of cystic teratomata or dermoids in the ovary can hardly be assumed to arise from multiple isolated blastomeres. Novak (16) reports ten dermoids in one ovary and eleven in the other. Cases of this type give great weight to the germ cell theory of origin. On the other hand we cannot account for the occasional teratoma of the mediastinum or pineal gland by this theory. Thus there are valid objections to both the blastomere and the germ cell theory.

Retroperitoneal teratomata may originate as do ovarian teratomata from an isolated blastomere or from germ cells of an accessory ovary retroperitoneal in location. They may

originate from germ cells which have remained at their primary embryonic location retroperitoneal and lateral to the spinal column. This explanation seems to apply best to the case I wish to report.

Cystic ovarian teratomata or dermoids are one of the commonest ovarian neoplasms. Their frequency is variously estimated at from 2 to 18 per cent of all ovarian tumors. Spencer Wells finds 2.2 per cent in a series of 1,000 ovarian tumors. Olshausen 4 per cent in something over 2,000 ovarian tumors. Bishop (2) in a recent review gives 7 per cent in 333 cases occurring at The Brooklyn Hospital. Kelly 18 per cent in 138 cases. During the past 5 years there have occurred on the gynecological service at Bellevue Hospital approximately 125 ovarian tumors with 10 cystic teratomata 8 per cent.

Bilateral cystic teratomata are comparatively common. Olshausen found 14 per cent to be bilateral. Pfannenstiel states that they occur in 10 per cent of cases. Gebhard

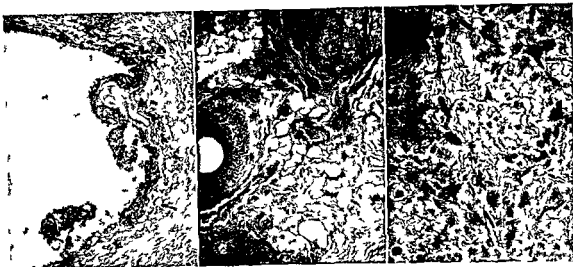


Fig 5

Fig 6

Fig 7

Fig 5 Section from retroperitoneal teratoma showing the many cysts lined by palisaded layer of epithelium.

Fig 6 Section from retroperitoneal teratoma showing various structures and hair follicle.

Fig 7 Section from retroperitoneal teratoma showing an area of myxomatous connective tissue with peculiar cells designated as dysgerm cells. They are neoplastic epithelial scattered here and there in various sections throughout the tumor.

in 107 cases found 16 bilateral growths. Kelly found one in 87 cases and Weiner one in 60 cases.

Malignant changes of any type in cystic teratomata are rare. The most frequent type of malignancy is carcinoma. This is usually of the squamous cell type and arises from the extensive epiblastic elements of the tumor. The ratio of development of carcinoma is usually given as occurring in from 3 to 5 per cent of the cases. Frankl (10) in 1920 was however able to collect only 60 authentic cases. Sarcomatous change in a cystic teratoma is very rare and but a few isolated cases have been recorded. These figures would seem to justify conservation of a portion of the ovary or ovarian resection in cases of bilateral cystic teratomata occurring in young women in whom subsequent pregnancies are greatly desired.

Solid teratomata are among the rarest of ovarian neoplasms. They are characterized by embryonic tissue derived from all three layers of blastoderm. The tissue is in a confused association without the attempt at definite structure so manifest in the cystic teratoma. The solid teratomata develop rapidly and are highly malignant. Graves

states that there are less than 50 cases of solid ovarian teratomata in the literature at the present time. In 1907 Frank (8) was able to collect only 37 authentic cases. Kroemig (13) reports 40 cases from the literature up to 1919. There is no case of solid teratoma in the records of Bellevue Hospital where the gynecological admissions will average 1800 cases a year. It has been suggested that the solid teratomata consisting largely of embryonic tissue originate from immature sex cells while the cystic teratomata consisting largely of adult tissue originate from more mature sex cells. Ashanzy (1) assumes that the adult tissues of the dermoid are of equal age with those of the host and that the tumor is in fact congenital while the solid teratomata showing embryonic tissue are postnatal in origin. Rossie (18) reports the case of a well developed dermoid in an infant of 10 months. Lever (14) reports a cystic teratoma in a female child of 7 weeks. Eggenberger (5) reports a dermoid the size of a child's head in an 8 year old child. Polak (17) states that prior to puberty dermoids are the commonest ovarian tumors.

The so-called struma ovarii in which evidence of thyroid tissue is found represent a





Fig. 8 (left) Section from teratoma showing loose connective tissue and myxomatous tissue. (right) Teratoma taken through placental site showing small bone fragments.

one-sided growth in a teratoma. They may be benign or malignant. Ticks in the dermoid found islands of thyroid tissue.

Retroperitoneal teratomata are as a matter of course decidedly unusual tumors. Their etiology, namely, that they probably arise from germ cells of the ovary or isolated blastomeres makes this location unusual. Lexer and Kolb have studied retroperitoneal teratomata most thoroughly. Lexer in a monograph on abdominal teratoid tumors both intraperitoneal and retroperitoneal reports four retroperitoneal teratomata. He states that most retroperitoneal teratomata are found in the left retroperitoneal tissue near the vertebral column. Kolb writing in 1909 states that Tilloux (10) in 1886 collected 33 cases of extra-ovarian abdominal teratoid tumors; these were intraperitoneal and retroperitoneal. Subsequent to this time the literature upon the subject has been sparse, especially references to retroperitoneal teratomata. Kolb collected five cases from the literature and added one case of his own.

The retroperitoneal teratomata are usually cystic and well encapsulated. They produce symptoms chiefly by pressure. There is no case on record of a solid or malignant tumor of this type.

#### CASE REPORT

The case I wish to report occurred in a woman 59 years of age. She was admitted to the Clark Memorial Hospital under the care of the writer October 5, 1924. She complained of abdominal pressure symptoms and an increase in the size of her abdomen for about 3 months prior to her admission to the hospital. She had no menstrual disturbance having passed through a normal menopause 5 years prior to this time. Abdominal examination showed a plainly palpable tumor mass apparently cystic in character occupying the right upper part of the abdomen. A pre-operative diagnosis of large ovarian cyst was made. She was operated upon on October 8, 1924. Operation revealed a negative pelvis; the uterine tubes and ovaries being normal. It was apparent at once that the tumor, a retroperitoneal as the posterior parietal peritoneum was almost in apposition with the anterior parietal peritoneum at about the umbilicus. The posterior parietal layer was incised and by blunt dissection the tumor enucleated. The tumor apparently arose from the cellular tissue to the right of the vertebral column, although there was no definite pedicle. The right kidney was adherent to the wall of the tumor and during attempted separation the kidney was traumatized. It was therefore removed with the tumor mass. The patient made an uneventful recovery leaving the hospital 16 days after operation.

For the detailed histological study of the tumor I am indebted to Dr. H. L. pathologist to the hospital and I will quote from his report: "Specimen consisted of a cystic mass 4 by 3 centimeters weighing 450 grams (36 pounds). It measures a thick wall which superficially contained a marked

amount of adipose tissue. Internally it is trabeculated and shows numerous small and large subsidiary cysts filled with brownish gelatinoid material. Occasional plates of what appears to be osseous tissue are found embedded within the wall. The contents of the main cystic cavity consists of a semi gelatinous brownish fluid. The specimen of kidney shows no gross pathology. Sections were taken from various portions of the tumor including what appears to be plaques of bone. The microscopic picture is variable. Necrosis is a prominent feature. In general the structure is of fibrous character. Scattered here and there are circumscribed collections of epithelial cells forming here acini and in other places solid alveoli. Some of the acini are lined with a palisaded layer of epithelium. In still other areas the epithelial cell are diffusely scattered throughout an edematous fibro adipose stroma in a disorderly fashion. Such areas suggest a potential malignancy. In the various sections one encounters areas of what appear to be true myxomatous tissue. Histological examination of the sections apparently incorporating plaques of bone disclosed a fibrillar connective tissue stroma in which small areas of histologically normal osseous tissue are present.

While in this tumor we found positive evidence of only two primary germ layers ectoderm and mesoderm I feel that the tumor should be designated as a teratoma rather than a teratoid or mixed cell tumor. Only by a very thorough study can we determine the absence of endoderm. Ewing states that there is little doubt that endoderm is the least vigorous of the three germ layers and may succumb early in the tumor growth.

## SUMMARY

1. The term dermoid is applied to ovarian neoplasms is inaccurate. So called ovarian dermoids should be referred to as cystic ovarian teratomata.

2. The histogenesis of ovarian teratomata is highly speculative. There are two seriously considered theories as to their origin one the so-called blastomere theory of Marchand and Bonnet and the other the germ cell theory of Wilms.

3. Cystic teratomata or dermoids are one of the commonest ovarian neoplasms. In a series of 125 ovarian tumors at Bellevue Hospital they comprised 8 per cent of the cases.

4. Bilateral cystic teratomata are comparatively common occurring in from 2 to 14 per cent of the cases.

5. Malignant changes in cystic teratomata are rare the most frequent type being squamous cell carcinoma. The ratio of development of carcinoma is usually given as from 3 to 5 per cent.

6. Ovarian resection is justifiable in cases of bilateral cystic teratomata in young women in whom subsequent pregnancies are desired.

7. Solid teratomata are among the rarest of ovarian neoplasms. There is no case in the records of Bellevue Hospital in which the gynecological admissions average 1800 cases a year.

8. So called struma ovarii may be benign or malignant.

9. Retroperitoneal teratomata are unusual tumors. There is no case of solid retroperitoneal teratoma recorded in the literature.

10. Report of a case of cystic retroperitoneal teratoma weighing 11 kilograms (26 pounds).

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## THE CALCAREOUS DEPOSITS OF SO-CALLED CALCIFYING SUBACROMIAL BURSTITIS<sup>1</sup>

By JOHN BIRTON CARPENTY, M.D., PHILADELPHIA, PENNSYLVANIA  
Professor of Surgery & President of the University of Pennsylvania School of Medicine

I HAVE personally operated on 14 cases of the condition commonly called calcifying subacromial bursitis for the removal of calcareous deposits and have assisted my former Chief Dr. Edward Martin in operation on 5 other similar cases. I have seen more than 25 shoulders in which a calcareous deposit was demonstrated by the X-ray but in which no operation was performed. In many of the operative cases there were bilateral deposits but operation was performed on only one shoulder.

Anyone attempting to familiarize himself with the literature dealing with these cases should read the papers of Codman in which he describes subacromial bursitis as the most common cause of stiff and painful shoulders. I believe that further investigation will demonstrate that a variety of lesions of which calcareous deposit is one may give rise to the symptom complex now usually ascribed to subacromial bursitis. Codman's contributions are classics in dealing with the mechanism of normal shoulder movements. His observations are supplemented by those of Stevens who has studied the action of the short rotators of the shoulder. Codman's clean cut description of the symptoms of subacromial bursitis and the mechanism by which they are produced has been accepted without much alteration by subsequent writers. I endorse the majority of Codman's observations and will quote freely from them in this paper.

Calcareous deposits were unknown when Codman published his first paper in 1906 and he makes no mention of them in it. Painter in 1907 was the first to report the finding of definite shadows in the shoulder by X-ray examination in 4 cases. He assumed that the shadows were caused by thickening of the walls of the subdeltoid bursa as did Baer who also reported 2 operative cases in 1907. In the light of our present knowledge there can be no doubt that both these authors were

dealing with calcareous deposits. They each reported having excised the entire subdeltoid bursa in 4 cases. Painter found the deposit in 2 of the specimens removed at operation but missed the deposit in the other 2 probably because he did not search for it underneath the floor of the bursa.

Painter and Baer reported the deposits as being located within the cavity or walls of the bursa itself but Codman saw Painter operate on one of the latter's 4 patients and observed that the deposit was not in the bursa but was located beneath the floor of the bursa. Codman reports Painter as agreeing with him that the deposits were beneath the bursal floor rather than in the bursa. Codman reported one case of his own in which the deposit was found at operation beneath the floor of the bursa. Codman was therefore the first to note the extrabursal position of these deposits. Many subsequent writers in describing single operative cases report the deposit as being in the bursa but it seems highly probable that the great majority of them did not make exact observations as to the actual position of the deposit in relation to the bursa. Their writings contain many other fallacies which still permeate recent literature notwithstanding Brickner's forcible efforts to overcome them in his two excellent papers in which he reports 18 operative cases.

The literature is confusing also because various writers use the terms subdeltoid bursa and subacromial bursa as though they were synonymous and interchangeable whereas other writers believe these two terms represent two separate and distinct bursae. The descriptions contained in different books on anatomy are likewise variable and confusing. My own experience indicates that Pier's *Anatomy* and Codman's and Brickner's papers are correct in describing only one bursa which lies in part beneath the acromion process and in part beneath the deltoid muscle.



Fig 1 A (left) Internal rotation Large shadow hours after onset of first symptoms B External rotation Deposit partly hidden by synovial ganglion

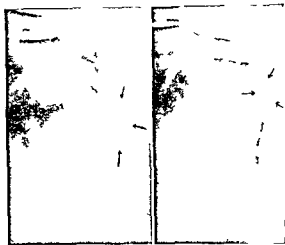


Fig 2 A (left) Internal rotation Large shadow free from bone B External rotation Deposit partly hidden by synovial ganglion

Surgical literature contains detailed histories of numerous cases quite similar to those I have encountered and it seems needless to give the individual record in each of mine. The clinical histories suggested a division of these patients into two main groups (1) the acute and (2) the chronic.

The outstanding symptoms in the acute cases were pain and fixation of the shoulder joint. The maximum pain was located commonly at the outer side of the arm over the lower half of the deltoid muscle and only exceptionally at the site of the calcareous deposit just beneath the acromion process. In many of the cases especially in those of longer duration the pain was referred from the neck all the way to the hand. Many of these cases had been undergoing treatment for brachial neuritis for several months. Several of them were tender along brachial nerve trunks but none of them had reactions of nerve degeneration. In all of the acute cases pain was aggravated by active and passive motions of the shoulder particularly in the direction of abduction and inward rotation. The pain was usually worse at night apparently due to the backward drag of the elbow. The patients could not lie on the affected side because direct pressure aggravated their pains. Many patients had learned they could obtain some relief at night by placing the arm on a pillow in a position of

slight abduction. The pain varied in intensity in different patients and in the same patient on different days. In some the pain was intolerable except when relieved by full doses of opiates. In the hyperacute cases the pain was as intense as that encountered in renal or biliary colic. In the non operative cases there was a natural tendency for the hyperacute pain to ease up after a few days or within two weeks. On partial subsidence of the pain patients were prone to resume active use of the arm too early and pain recurred. Usually the pain became less severe and all the symptoms merged over into the chronic type of the disease.

In the acute cases the range of motion at the shoulder joint was greatly restricted by muscle spasm and pain. There was never complete fixation nor ankylosis of the joint. The shoulder was least restricted in backward and forward swinging motions at the side of the body. After the patient's confidence had been gained passive abduction of the arm was usually free through an arc of about 10 degrees directly outward from the side of the body. Further abduction either actively or passively was not possible in the shoulder joint itself but by rotating the scapula on the chest nearly all these patients were able to bring the arm outward to about a 40 degree angle from the lateral chest wall.

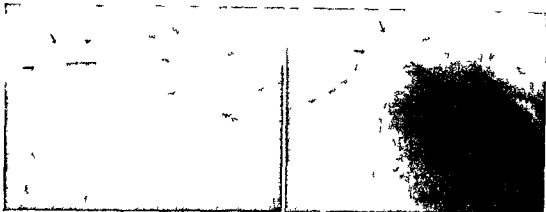


Fig. 3. (left) Arm in position. Large deposit at acromioclavicular joint. (right) Arm abducted 80 degrees. Deposit apparently on greater tuberosity.

Inward rotation was restricted in all acute cases as evidenced by inability to place the hand behind the back. The patients were unable to comb the back hair and could not fasten suspender or rear skirt buttons. The men could not introduce the hand into the hip pocket. External rotation usually was fairly free but was restricted and painful in several.

In a few of the acute cases atrophy of the deltoid supraparatus and infraspinatus muscles was more marked than would be expected simply from non-use. In none of these patients was there a swelling or fluctuation indicative of fluid accumulation in the subacromial bursa. In 6 cases efforts to obtain fluid from the bursa by apiration proved futile. One patient only had edema which was moderate in amount and was located in the lower deltoid region. The same patient was the only one to exhibit any fever and her temperature barely crossed 100 degrees. Skinograms demonstrated the deposit of lime salts in every acute case.

The chronic type of cases either began as such or were originally of the acute type. Pain both as to localization and radiation was similar to the acute cases but varied greatly in intensity in the individual patients. In different patients the pain was constant, intermittent or remittent over a period of weeks, months or years. Mild exacerbations of pain lasting from several days to a few weeks were frequent either as the result of exercise or

without obvious cause. Several patients had very acute exacerbations in which the pain was as viciously severe as in the acute type of cases. In the milder cases and during remissions in the severer cases pain was felt only during extreme inward rotation or abduction to or above the shoulder level.

In elevating the arm from the side of the body to a perpendicular some of the patients would experience pain only when the arm was passing through that portion of the arc from 75 to 90 degrees and on dropping the arm to the side would experience similar pain when the arm was within the same arc. A few of these patients could go through the same motion painlessly by holding the humerus in a position of external rotation (palm up and elbow lightly flexed).

Limitation of motion varied greatly in the chronic cases. In some motion was practically free except for causing bearable pain in abduction in extreme inward rotation and in circumduction at the shoulder level. In the majority however there was more or less marked restriction in abduction and inward rotation either with or without restriction of external rotation. Limitations of motion were more marked during exacerbations of pain due to the pain and muscle spasm. Maintenance of the arm in its restricted position in long standing cases led to contractures of the shoulder muscles and to atrophy which was most evident in the deltoid supraparatus.

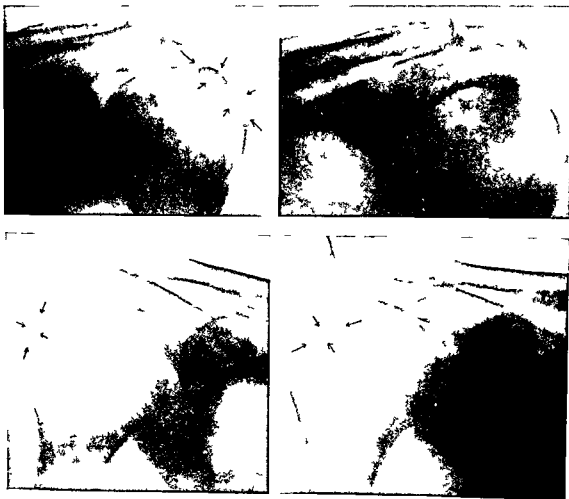


Fig 4. Bile deposits (upper left) Left shoulder. Multiple deposits (upper right) Calcific tendinitis (lower left). Symptomatic right internal rotation. The deposit had well-defined borders (lower right).

by growth but at once peculiarly the deposit had well-defined borders (lower right). Right arm in extension. The humerus and deposit showed superimposed shadows of right humeral head for 6 months. Deposit truly large.

and infraspinatus muscles. In a few of these patients the chief complaint was disability rather than pain.

In many chronic cases the condition apparently ran a self-limiting course and irrespective of treatment the patient made a complete recovery at varying periods from a few months up to three years. In a very small percentage of cases the condition persisted over a longer period of years (up to twenty years) and there were apt to be long periods of remission of symptoms. The calcareous

deposit was demonstrated by a skiagraphic examination in every chronic case.

With but one exception in all cases both operative and non-operative acute and chronic the patients who were suffering either from pain or limitation of shoulder motion had a characteristic area of localized tenderness just beneath the acromion process on the anterior or anterolateral aspect of the upper arm usually over the site of the lesser tuberosity. One operative case of the chronic type did not exhibit any localized tenderness.



Fig 5 Huge deposit on July 18 1922 Spontaneous absorption. Shows entirely absent on April 3 1922 & d September 27 1924

weeks and 2 weeks respectively prior to the acute exacerbation but there was exquisite tenderness the day of operation. The presence of a sharply localized finger tip to quarter dollar sized area of tenderness was found to be a valuable sign in making a differential diagnosis from a general arthritis of the shoulder joint as in the latter condition the head of the humerus is tender to finger pressure throughout its entire circumference. The majority of the patients however were not aware of having this area of tenderness until it was revealed to them by the surgeon's examination. Many patients were slightly tender over a corresponding area in the opposite and otherwise apparently normal shoulder. In several patients with unilateral symptoms but with bilateral calcareous deposits tenderness was absent in the shoulder that was free from pain and stiffness. The area of tenderness disappeared under the acromion in wide abduction (Dawbarn's sign) in all cases in which it was tested.

Nearly all of the 19 operative cases were either of the acute type or were in the acute exacerbation stage of the chronic type at the time they first came under observation and almost all of them were operated upon within the first 24 hours thereafter. The first one of these cases a physician was operated upon in

1907 by Dr Martin. In the first 8 of the 19 operative cases the sole aim of the operator was to remove the calcareous deposit and no effort was made to determine either the exact location of the deposit or the presence of possible pathology in the bursa itself. The deposit was removed in every instance and all but one untraced patient are known to have been cured. The conditions encountered in the operative field were studied very carefully in the subsequent cases.

#### OPERATIVE TECHNIQUE

At operation a sand bag was placed under the scapula to tilt the patient away from the affected side thereby rendering the field of operation more accessible. The arm forearm and hand were swathed in a sterile sheet to permit of later manipulation. An incision was made parallel to the fibres of the deltoid muscle extending from the edge of the acromion process downward for 2 to 3 inches toward the insertion of the deltoid and crossing the greater tuberosity.

The deltoid muscle was split in the direction of its fibres by combined sharp and blunt dissection. The deeper muscle fibers were carefully pushed aside to expose the roof of the subacromial bursa. The thin wall of this sac was then carefully incised for a distance of 1 inch or more. In only one instance was there any difficulty in entering the sac and that was because of extensive adhesions within the bursa. By retraction of the wound and manipulation especially rotation of the arm the bursal walls were separated to permit of an extensive survey of the interior of the subdeltoid portion of the sac. An attempt to illuminate the subacromial portion of the sac by introducing a small electric light in one case was unsuccessful. A curved hæmostat or a finger aided if necessary by manipulation of the arm was then introduced to explore the interior of the sac. Eight of the earlier cases were not examined so thoroughly and it is possible some pathological changes may have escaped notice in them but on the whole in the 11 more recent operations the changes involving the bursa itself were relatively insignificant.

In 1 case the bursal sac was completely obliterated by recent fibrinous adhesions which



Fig 6 Left shoulder A (left) Internal rotation large shadow B External rotation Deposit barely visible in acromion shadow

were readily broken up by the finger. In 3 cases there was some thickening and adhesions of the most dependent portion of the bursa. In 2 of them a small portion of the sac was excised and in the third the adhesions were simply separated. In 1 of the above 3 cases and in only 2 others a trifling amount of serous fluid was found. In all but 2 of the cases the calcareous deposit could be seen as a gray patch and usually was palpable to a finger tip as an area of altered resistance beneath the unopened floor of the bursa.

As the next step in the operation the floor of the bursa was incised over the calcareous deposit. In 4 cases this incision exposed the deposit. Usually however a deeper incision had to be made to expose the deposit which was found in the supraspinatus tendon. In cases in which the deposits were situated on the deep aspect of the supraspinatus tendon there was no discoverable superficial index as to their location and they were sought by exploratory incision at the area indicated by the X-ray and by the localized tenderness. In 1 case the deposit was found at the first incision and in the other only after an extensive search.

These deposits varied greatly in consistency. One was not unlike the consistency and color of staphylococcal pus; usually the deposit closely resembled the appearance and consistency of the contents of a sebaceous cyst; in 2 the deposit was rather dry and chalk-like but not gritty; and in 2 it was granular and gritty.

The major portion of the deposit was lifted out with a blunt curette. Quite commonly the irregular walls of the cavity were smeared or infiltrated with the deposit and had to be trimmed away with knife or scissors. Multiple deposits in some cases called for secondary incisions into the tendon.

The subsequent steps of the operation were carried out in different ways. When there was a definite cavity in the tendon an attempt was made to obliterate it by fine chromic catgut sutures. In a few earlier operative cases the floor and the roof of the bursa were closed with catgut and drainage was not employed. More recently neither the floor nor the roof of the bursa was sutured and a small rubber drainage tube was inserted through the deltoid muscle for 24 hours to provide for oozing blood and serum which often was fairly copious. The



Fig 7 Right shoulder May 31 1920. Deposit dumb-bell shaped large faint shadow. Ski-gram demonstrates complete spontaneous absorption.





Fig. 8. Right shoulder. (Left) July 15, 1922. Fat  
nipple. Dependent. (Right) July 15, 1922. Fat  
nipple. Dependent. (Left) July 15, 1922. Fat  
nipple. Dependent. (Right) July 15, 1922. Fat  
nipple. Dependent.

Almost complete abduction. A new deposit  
of fat medial to the axilla.

deltoid fiber and fascia were united with three interrupted catgut sutures and the skin was closed by a continuous suture. The gauze dressing was held in place by a adhesive plaster in preference to a bandage in order to favor early shoulder motion.

The postoperative position of with abduction so commonly recommended to prevent adhesions was found so uncomfortable that it was early abandoned. Practically all these patients had only a bandage sling to the wrist and rested the arm in a position of moderate abduction on a fat long pillow which rested partly on the mattress and partly across the lower chest and abdomen. They were not restricted to this position but from the first day were encouraged but not obliged to re-

move the hand from the sling at intervals and extend the elbow to shift the position of the arm on the pillow to move the shoulder in any direction they could and even to sit up in bed or in a chair. Beginning at the end of the second or third day they were obliged to begin passive motion in the direction of abduction by interlocking the fingers of the two hands and using the well arm to elevate the bad arm. On the third or fourth day they were required to stand in a doorway or at some offset in the room and gradually inch their finger tip up the wall. This exercise was repeated four or five times daily until they could reach the maximum height level established by the finger tip of the sound side. During the early days of this exercise the upward climb of the fingers was aided by using the sound hand to grip and elevate the affected forearm or elbow and by having the patient step closer to the wall as the fingers ascended.

Beginning on the third day or soon thereafter the patient while sitting rested the arm on a table or on gradually increasing higher piles of books or pillows laid on the table and from time to time depressed the body to increase the range of abduction. Occasionally within one week and frequently within ten or twelve days after operation the full range of shoulder abduction was demonstrated by Codman's maneuver of having the patient stand with knees extended and touch the floor with his finger tips. About the fifth or sixth days efforts were begun to restore in



Fig. 9. (Left) Left shoulder. (Right) Right shoulder. (Left) July 15, 1922. Fat  
nipple. Dependent. (Right) July 15, 1922. Fat  
nipple. Dependent. (Left) July 15, 1922. Fat  
nipple. Dependent. (Right) July 15, 1922. Fat  
nipple. Dependent.



Fig. 1. (left) Left shoulder. External rotation. Deposition of B (middle). Internal rotation. Deposition of C (right). Right shoulder. Small deposits.

which were shown partially absorbed in 7 weeks and almost completely absorbed in 8 months.

ternal rotation by having the patient pass his sound hand across his back and grasp and make traction on the thumb or wrist of the affected side.

It should be noted that although these exercises are carried out by the patient himself they are largely of a passive character and do not call for much muscular effort on the part of the affected shoulder. Active exercises are encouraged from the first and insisted upon after the first few days. The exercises were started early to prevent adhesions and were preferably and usually carried out by the patients themselves. Because they could exercise their arms dozens of times daily and could keep their shoulder motions within the range of pain tolerance they made more rapid and more comfortable progress than if they had had to depend upon a nurse or a physiotherapist. For the acute cases in which limitation of motion was due mainly to muscle spasm the preceding exercises were adequate to restore full but somewhat labored motion within 10 days' time.

In all the acute cases relief from the pain immediately followed the operation. Frequently the patients upon recovery from nitrous oxide oxygen anesthesia reported within 1 or 2 hours that the old pain was gone and they were usually more comfortable the first

night after operation than they had been the few nights preceding it. The patients usually were able to leave the hospital within a week or 10 days. Several physicians left the hospital on the first, second, and third days after operation.

Cases of chronic type with but 2 exceptions were all operated upon during an acute exacerbation. Operation gave them relief from pain only to the extent to which the pain had been increased during the acute exacerbation. The chronic pain they had before the acute exacerbation persisted after the operation and disappeared only after a few to several weeks.

At the time of operation on the chronic cases in which limitation of motion was at least in part due to contracted muscles only moderate force was used in making shoulder manipulations to restore motion. Moderate force was frequently adequate to restore full motion but sometimes only an incomplete range of motion was obtained. In the chronic cases the patients were instructed to carry out the same postoperative exercises as in the acute cases. In the chronic cases however much less rapid progress was made because of the persistence of the original subacute pain. Their own efforts at exercise very commonly had to be supplemented by surgeon, nurse and physiotherapist both within the hospital



Fig 1 (above) Bilateral deposits. B (below) Left shoulder 100 deg abduction. On July 29, 1924 large left deposit absorbed. Still right shoulder deposits unchanged.

wherein their average stay was longer and after going home. Baking massage and vigorous passive motions had to be employed in many of these cases. A very good device for the patient to use in his home for restoring motion in this and other types of shoulder fixed in adduction consisted of a clothes line rope and an overhead pulley, each of which was purchased at a ten cent store. At the high points to which the patient could readily reach with his hands two loops were tied in the rope to serve as hand grips. The two ends of the rope were left long to facilitate the grasping of one loop in each hand. A downward pull on the rope by the upward extended sound hand elevated the affected hand and arm and by seesaw movements of the rope the angle of abduction was further increased.

Again this is a form of passive motion which was carried out by the patient himself.

Restriction of outward rotation disappeared spontaneously after operation in the acute cases but required corrective measures in a few chronic cases. I have gained the impression that the pain which persists after operation in the chronic cases clears up less rapidly under prolonged rest than under forced exercises provided the latter are not overdone to the point of aggravating the pain.

In several chronic and a few acute cases massage and special exercises such as swinging Indian clubs and swimming had to be employed to overcome atrophy of the shoulder muscles even after motion was fairly complete.

#### DISCUSSION OF CASES

I have seen more than 25 shoulders in which calcareous deposits were definitely proved by X-ray examination but in which operation was not performed. Four of these patients had bilateral deposits but had the deposit removed from one side only.

One of these 4, as a physician who had angina pectoris of several months' duration and recurring pain and stiffness of the left shoulder for over 20 years. He had never had any disability in his right shoulder. X-ray showed a definite deposit in each shoulder (Fig 4). The left shoulder was tender and the right was not. It was difficult for him to differentiate between his angina pain and left shoulder deposit pain. He insisted on operation which was performed on May 5, 1924, under local anesthesia. He left the hospital and went to his home at a distance of 200 miles on the third day. Under date of September 25, 1924, he writes that after operation he had some dull indefinite pain for some time but at this time I am entirely free of any discomfort in that shoulder and have had no discomfort for some time. Concerning the unoperated right shoulder he reports: "I never had any discomfort in my right arm or shoulder until six weeks ago when I was awakened by quite acute pain in the right shoulder which prevented my sleeping until after I had applied heat by means of an electric pad and then I slept through the night. On getting up I had a feeling of soreness and dull aching which persisted for several days then it disappeared and again made its appearance a week ago was annoying for three days and at present seems to have gone. Unquestionably this pain is due to the calcareous deposit in my right shoulder and should it continue I will have deposit removed." An X-ray picture of his right shoulder taken on September 25, 1924, shows the same shadow as pictures taken on March 8, 1924, and on May 4, 1924.

**CASE 2** Patient had bilateral deposits proved by X ray. She had had bilateral symptoms for many years. When she first came under observation she was having an acute exacerbation in one shoulder and the other shoulder was only slightly but rather continuously painful. Motion in both shoulders had been greatly restricted for years. I operated on the acute shoulder and removed the deposit. She was one of my early cases and I gave her an unduly favorable prognosis. With a personal experience based largely on acute cases I was under the delusion at that time that excision of any depo it was also synonymous with speedy cure of all symptoms and so advised her. Her acute pain was relieved by operation but the chronic pain persisted and there was not much improvement in shoulder motion during the 2 weeks she was in the hospital. I have not been able to get any news of her condition since she went to her home in a distant town.

**CASE 3** Patient was a physician who had several weeks of mild symptoms during which two examinations failed to show any tenderness over the affected left shoulder. He then had a complete remission of symptoms and after taking a bath one night at 10 o'clock he was able to use a bath towel painlessly in the good old-fashioned seesaw way which required full range of shoulder motion in every direction. He then announced to his wife that he was completely free of his trouble. At 3 o'clock of the same night he was awakened by agonizing pain in the left shoulder. His shoulder exhibited the typical hyperacute tenderness and the typical limitations of motion of the acute type. An X ray picture (Fig. 10A and B) taken the same day demonstrated a deposit in the left shoulder but no picture of the right shoulder was taken. At operation the same day, January 16, 1923, the bursa was found obliterated by fibrinous adhesions which were broken up with a finger and the deposit was excised. He left the hospital on the third day and resumed his work as a skiagrapher on the fifth day after operation. He had no further trouble in his left shoulder. About 1 year later he began having mild symptoms in the right shoulder and an X ray picture (Fig. 10C) on January 19, 1924, revealed a definite deposit in the right shoulder. Several pictures taken since then show gradual absorption of the deposit. In the last picture on September 11, 1924, it casts a barely perceptible shadow. The clinical symptoms have been of the milder remittent chronic type and were at about their worst when the last picture was taken.

**CASE 4** was a physician who had chronic fairly constant pain for several months with marked restriction of abduction of his left shoulder followed by an acute exacerbation and an operation on December 31, 1920. At operation the bursa was entirely free from any suspicion of disease and yet he was one of my worst cases of contracted muscles. By using a considerable amount of force and by snapping adhesion during the operation I was not able to bring his arm out to a full right angle. The depo it was removed. He left the hospital on

the fifth day. The acute pain subsided but the original chronic pain persisted for several months. He was an extremely busy out of town physician and could not be forced to carry out postoperative exercises but eventually the pain left and the shoulder motion greatly improved. A skiagram was not taken of the opposite shoulder at the time of operation. Recently I recalled that while he was in the hospital for his operation and subsequently he had complained of a painless stiff right shoulder and for that reason called him on the telephone to request him to have a radiogram taken of the right shoulder. He then stated that for the past few weeks he had been having periodic pains in the previously painless right shoulder and a skiagram taken on September 27, 1924, showed a pinhead deposit in it.

I have seen 2 non operative cases of bilateral deposits with unilateral symptoms in the wives of physicians.

One of the 6 patients began 9 years ago to have pain of a fairly constant character and very commonly worse at night in the left shoulder and radiating down the arm. She had marked atrophy of shoulder muscles. A skiagram from one angle only taken in 1917 was negative. A bilateral skiagram (Fig. 11) taken on June 28, 1921, revealed deposits in both shoulders. After this picture was taken the symptoms in the left shoulder began to subside and she has not had any trouble in it for over 2 years. A skiagram taken on September 9, 1924, shows disappearance of the large dense shadow in the left shoulder without much change in the tiny shadows in the right shoulder. She has never had any trouble in the right shoulder.

The second patient slipped coming down stairs, grasped the banister and severely twisted her left arm in early January, 1924. The shoulder was uncomfortable for 1 week and then was free from symptoms for a month when she rapidly developed severe constant pain causing her to walk the floor night after night. She took gallons of medicine for neuritis. An X ray picture of the shoulder taken on July 4, 1923, disclosed a large deposit. Since then her pain has rapidly subsided and she now has only slight pain as the arm approaches the level of the shoulder in full abduction. Her right arm has always seemed perfectly normal but a radiographic examination made on September 30, 1924, revealed a small and hazy but unmistakable deposit in the right shoulder and a complete disappearance of the large dense shadow formerly in her left shoulder.

In one instance I had the unusual experience of discovering accidentally bilateral deposits in a patient who had been skiagraphed for another lesion. Stereoscopic X ray films were made of the chest of a patient who had metastasis to the lungs secondary to a cancer of the breast. The shadow of a calcareous deposit

was shown in each shoulder but both shoulders were free from symptoms

Another instance of accidental discovery of deposits occurred recently when a study was being made of the supraspinatus tendon in 6 shoulders in the postmortem room. The fifth shoulder contained four small deposits two being in the supraspinatus tendon and two in the subscapularis tendon. So far as could be learned the patient had never complained of any shoulder symptoms.

The majority of my patients did not have both shoulders x-rayed hence other bilateral cases may have escaped detection.

In addition to the preceding 3 cases of bilateral deposits in which there was spontaneous absorption of the deposit in the one shoulder of each case I have seen 4 other unilateral non-operative cases in which there was a subsequent complete or almost complete disappearance of shadows in from 4 months to years.

One patient with unilateral symptoms of hyperacute form in January 1919 had a very large shadow (Fig. 5) which had almost completely disappeared in a picture taken 3 months later but he still had painless marked limitation of abduction which soon cleared up following the use of a rope and pulley. Pictures of both shoulders taken on September 28, 1924, were entirely negative.

A physician's wife had a moderately severe acute attack of pain and limitation of shoulder motion with a characteristic point of tenderness. A skiagram (Fig. 7) taken on the third day showed a lens-lumbell-shaped shadow and a larger second lesion but hazy halo. She elected to try rest in bed with arm moderately abducted on a pillow until the acute symptoms subsided. Both shadows had disappeared in 4 months but minor symptoms recur from time to time during the next 2 years whenever he attempted to play the piano for long periods and playing golf was impossible. She has not had any symptoms for over a year. Her opposite shoulder was never skiagraphed.

A man with minor symptoms of chronic recurrent type had a small dense halo which had nearly disappeared a year later, as entirely gone in 18 months and he has not had any symptoms for the past 9 months.

A physician had chronic symptoms with fairly acute exacerbations following an uncertain injury in an automobile accident. It was treated for brachial neuritis for 4 months and then the first x-ray picture was taken and it revealed multiple deposits four months later the largest deposit had nearly disappeared but the pinhead-sized ones were unchanged and there was no shadow in opposite

shoulder. There was marked improvement in his symptoms but movements such as the overhead swimming stroke cause pain.

Until more convincing evidence is forthcoming I will continue to believe that the generally accepted view that these deposits can make a miraculous disappearance within a very few days is really due to an x-ray fallacy. I had two cases in which I formerly supposed deposits had disappeared spontaneously within 5 days as proven by x-ray evidence. Films in one angle only were taken in each case. I now suspect that in both instances the skiagram was taken at the favorable angle to show the deposit on the first day and at the opposite angle with the concealment of the deposit by the superimposed bone shadow on the fifth day. Unfortunately I have not been able to trace either the patients or their films in order to check up on this surmise.

One of these 2 patients was a rather curious case in a colored man. He had right shoulder subacute symptoms of sufficient severity to be anxious for operative relief. A single plate of each shoulder proved negative for the painful right shoulder and showed a dense typical deposit in the otherwise normal left shoulder. To eliminate possible error in the labeling of the plates, second pictures were made by another roentgenologist on the fifth day and no traces of the former shadow could be detected in either of the single plates taken of each shoulder. The patient was not operated upon and was not seen subsequently.

In several of my cases and in many reported ones the deposits have apparently made their appearance with amazing rapidity. Absolute proof as to the speed with which these deposits form has not been determined by a first skiagram which is negative and a second which shows a definite shadow. I have had several early cases of shoulder injuries x-rayed hoping to clear up this point but my efforts have been futile.

One of my cases is in a man who developed hyperacute unilateral shoulder pain after driving an automobile on a stormy night. A skiagram (Fig. 1) taken within 12 hours of the onset of symptoms showed a typical large dense shadow and a corresponding light spot was found at operation 3 hours later.

It has been generally assumed that these deposits do not antedate the onset of symp-

toms mainly for the reason that it is extremely rare to find them in routine X ray examinations of shoulders except when the symptoms of the deposits are present. It has been argued that if these fairly common deposits could exist without symptoms they should be encountered frequently in skiagrams taken for other shoulder lesions. Elsewhere in this paper I have shown that (1) symptomless bilateral deposits in the shoulders have been found accidentally in stereoscopic films of pulmonary cancer (2) a deposit has been present as long as 3 years without causing any symptoms (3) a deposit has been present but quiescent for 4 months and then caused symptoms (4) deposits have disappeared spontaneously and (5) a large dense deposit has been present and has not been demonstrable in an X ray picture of the shoulder taken from only one angle especially if it was the common position of having the patient's hand resting on the chest or abdomen. In view of all these facts I believe that the large dense deposits which are found within the first day or a few days after the onset of symptoms must be instances of pre existing latent deposits.

The remainder of the non operative cases were all of the milder subacute type and have drifted away. The nature of their affection was explained to them with suggestions as to treatment and they were advised to return for operation in the event of an acute exacerbation. That so many of them have not returned would seem to imply that many of them experienced the frequent betterment that occurs with the lapse of time.

#### ETIOLOGY

All recent writers agree that injury to the tendon of the supraspinatus muscle is a definite etiological factor in the production of calcareous deposits yet they all agree that a history of a definite single trauma is unobtainable in a considerable percentage of cases.

According to the commonly accepted theory a partial rupture of the supraspinatus tendon is the injury which is usually responsible for the deposition of the lime salts. Localized tears in this tendon have been observed at operation and postmortem in the absence of deposits and they have also been found at

operation at the site of the deposit. In none of my cases was I able to determine that the cavity containing the deposit was due to rupture of tendon fibres. If partial tendon rupture had caused the cavity in any of them all evidence of rupture had been masked by inflammatory changes before operation was performed.

An unusually high percentage of my cases occurred in physicists and physicians wives. Only a few of this intelligent group were able to assign an adequate trauma as a cause for their symptoms. I believe that in a fairly high percentage of cases the deposition of the lime salts occurs quietly as the result of mild repeated traumata and precedes by days weeks or months the onset of the clinical symptoms. After the deposit has formed a very mild trauma may then incite an acute inflammation with a rapid development of the classical clinical symptoms. It also seems probable that some of the supposed partial tendon ruptures found at operation or autopsy may in reality have been tendon defects (cavities) caused by a deposit which may still exist or may have been absorbed. Or a tendon weakened by a deposit may rupture from slight violence in which event the partial rupture is the result and not the cause of the deposit.

As in several of my patients Moschcowitz and others have found microscopically that necrosis of tendon tissue is present in these cases Moschcowitz has made a careful pathological study of the tissues from Brickner's operative cases and he has found that the lesion is one of tendinitis necrosis and calcification. These findings are borne out by pathological reports in my cases.

The blood supply of tendons is notoriously poor. The tendon of the supraspinatus is so situated that it is frequently subjected to single accidental violent trauma and to milder many times repeated occupational pinches between the acromion and the head of the humerus in abduction. A partial rupture or a violent contusion either from pinching or from an external blow might directly destroy the scanty blood supply. Milder frequently repeated traumata of the occupational variety might readily produce the same result in

directly by chronic inflammation. The localized *exstremia* would then result in localized necrosis and deposition of lime salts.

The tendon of the supraspinatus is subjected to frequent and repeated traumatism both by muscular action and by direct and indirect violence. The supraspinatus is relatively a very small muscle to be a principal abductor of the shoulder and being attached to the short end of the long, widely moving lever represented by the arm is particularly susceptible to lesions resulting from muscular strain. It is therefore not surprising that partial rupture of the tendon may result from sudden unexpected muscular strains such as occur when the patient suddenly abducts the arm to prevent falling. In many of the reported accidents it is impossible to determine whether the main factor in the injury is the muscular strain or the internal violence due to pinching of the tendon between the humeral tuberosity and the acromion process in the position of abduction. Both forms of violence probably act together in many of these cases and it is possible that the point of partial rupture of the tendon may be determined by the site at which it is compressed between the humerus and acromion. This mechanism would serve to explain why rupture and contusions are so common in the distal end of the tendon and are apparently so rare in the muscle fibers and in the proximal end of the tendon.

Other forms of muscular violence which seem to have played a part in these cases are (1) overuse as in a baseball pitcher (2) unaccustomed use as in playing baseball without proper training or in throwing a heavy club into a high fruit tree and (3) occupational stress with the arms held in slight abduction as in piano players, typewriters and machine operators. In all three of these groups the element of pinching of the tendon cannot be eliminated and it may indeed be the prime factor.

The acromion process might very reasonably be regarded as an essential although an extracapsular part of the shoulder joint. Stevens has shown how the short rotators of the arm tend to prevent the upward thrust of the humerus caused by the contraction of the abductor muscles. The normal clearance

space between the acromion and the humeral head is very slight and there must be many occasions when the short rotators fail to act perfectly and then the upward thrust of the abducting humerus is arrested by impact against the acromion. Particularly is this impact prone to occur in the arc of abduction between 75 and 85 degree as the projecting tuberosity passes under the acromion process or coraco acromial ligament. The acromion process may very reasonably be regarded as an essential part of the shoulder joint itself as it resists the tendency to upward dislocation of the humerus and affords a gliding support to the humeral head during abduction and rotation. In other joints intracapsular articular cartilages cover the bone surfaces which engage in a similar gliding function. The extracapsular subacromial bursa is a poor anti friction substitute for the articular cartilages and undue friction results between the acromion and the tendon covered head of the humerus. The supraspinatus tendon as it winds over the head of the humerus is thus exposed to repeated contusion and friction in a way not encountered with any other muscle or tendon.

Several writers including Codman, make only passing mention of contusion as the cause of the tendon injury but I believe contusion is a very important factor. Many patients with shoulders otherwise normal both clinically and roentgenographically exhibit marked tenderness over the tuberosities due almost certainly to mild occupational trauma.

Falls on the outstretched hand or on the elbow constitute a form of indirect violence in which the tendon is forcibly compressed between the humerus and the acromion. In these accidents the element of muscular action frequently cannot be eliminated and possibly it may be a contributing or even the main factor in many of them.

The supraspinatus tendon is exposed to direct violence by falls or blows on the point of the shoulder. I think the importance of this mechanism has been overemphasized. Frequently patients get hurt in somewhat complicated accidents and because of the shoulder pain assume they must have been struck in

that region. On cross examination they cannot recall having sustained a blow on the shoulder and the nature of the accidents were such that muscular violence or abduction compression of the tendon or both could have happened. A perusal of case histories does not indicate that this form of direct trauma is at all frequent.

The reported cases of calcareous deposits have not followed severe shoulder injuries. It seems probable that these deposits do occur after severe injuries and are then erroneously regarded as fractures of a tuberosity. I have recently had a dislocation of the shoulder which exhibited an X-ray shadow which did not permit of differentiation between shell fracture and calcareous deposit. An X-ray picture four months later demonstrated complete disappearance of the shadow. A fracture fragment may have been absorbed but I am inclined to believe that the original shadow was caused by a deposit. If the possibility of a deposit is kept in mind in all shoulder injuries and a careful comparison is made of the tuberosities in stereoscopic pictures of both shoulders I anticipate that many of the suspected fractures of a tuberosity will turn out to be calcareous deposits. On the other hand I suspect that many of the cases which have been reported in the past as fractures of the greater tuberosity from muscular violence often mild in character were in reality cases of calcareous deposit.

My findings agree with Brickner's views that some factor other than trauma probably a disturbed metabolism plays a part in these cases. Brickner points out that the deposit occurs only in adults; it occasionally is encountered first in one shoulder then in the other; in some persons the deposit undergoes absorption; in others it persists; although a common affection many persons using their arms in the same way and subjected to the same influences never develop it; it occurs among the muscular and athletic as well as the sedentary and asthenic; in females as well as in males; no other hypothesis can explain why in some persons within a day or two after some mild internal violence or an external injury the roentgenogram will reveal this characteristic deposition of lime salts above the greater tuberosity of the humerus. I

might add that the symptomless development of deposits in the absence of acute trauma is further evidence in favor of metabolic disturbances.

The patients in whom the deposits occur are not of a gouty type. Infection and toxemia are not factors. Only one of my patients had fever and her temperature rose barely over 100 degrees F. She had an associated edema of the lower deltoid region and was the only one of my patients that had edema. She was an early acute case; was 1 of the only 3 of my patients who had an effusion within the subacromial bursa and was 1 of a different group of 3 in whom I found some localized thickening and adhesions of the bursal walls. Cultures from the bursa and from the deposit were negative as were all the cultures taken on several other patients. Many of my cases before the diagnosis had been made were treated for various forms of toxemia without benefit to the shoulder.

On radiographic examination the calcareous deposits cast a shadow of varying density. The shadow may be thin and hazy or quite as dense as bone. Shadows of both extremes may exist in the same patient. The deposits may be single or multiple and may be unilateral or bilateral. They vary in size from a pinhead to a silver quarter-dollar. They occupy different positions in relation to the head of the humerus in different patients. They often escape detection when a skiagram is made from only one angle because the deposit shadow is superimposed on the bone shadow of the humerus or the acromion.

I feel greatly indebted to Dr. Henry K. Pancoast, Dr. Donald J. Zulick and Dr. B. P. Widmann for their kindness and courtesy in making the majority of the radiographic examinations in my patients and for testing out various methods of demonstrating the presence of these deposits. Their painstaking examinations often revealed the presence of deposits in patients who had had negative X-ray pictures taken elsewhere within a previous few days. I am convinced that many of these deposits are not shown by the ordinary X-ray examination of shoulders.

In making a radiographic examination of the shoulder for calcareous deposits Dr. Pan



coast advises the following procedure. The rays should be directed from above downward and from within outward in order to show a space between the shadows of the acromion process and the head of the humerus. The calcareous deposit is usually brought still more into prominence by external rotation of the upper arm. From the diagnostic standpoint more information can be gained as to the exact location by stereoscopic plates made on the Bucky table. This procedure is also more likely to show deposits hidden by the head of the humerus for the reason that there is more penetration of the bone.

If stereoscopic pictures are not taken at least two skiagrams should be made in every case. In one the arm should be held in inward rotation to the extent that the hand of the flexed elbow rests on the patient's chest. In the other the arm is rotated externally by flexing the elbow to a right angle and turning the hand as far away from the body as possible which usually means the back of the hand rests on the table on which the patient is lying. In one position or the other the deposit shadow will usually be shown clear of the bone while in the opposite position even dense deposits are frequently obscured or totally hidden by the superimposed bone shadow. Very exceptionally the two shadows may be superimposed in both positions hence it is desirable to make stereoscopic plates before a negative X-ray diagnosis is made. In an unusual case now under observation X-ray films in both positions of rotation show two small shadows which simulate deposit shadows overlaid by bone shadow. Stereoscopic examination shows that these shadows lying within the humeral head are probably due to localized areas of bone condensation. The patient has the characteristic Codman symptom complex.

Recently in a few cases I have been able to predict which position of rotation will disclose the deposit if one be present by studying the position of the tender area in relation to the humerus and the direction which the X-rays will travel to strike the film. Whether this observation will hold good even in the majority of cases remains to be seen. I believe the tender area below the acromion coincides with the site of the deposit.

The symptom complex in these operative and non operative cases of calcareous deposit is exactly the same and occurs in other patients in whom the most careful X-ray examinations fail to reveal any evidence of a deposit.

Prior to the appearance of Codman's classical paper on stiff and painful shoulders in 1906 patients with these symptoms were erroneously labeled as cases of brachial neuritis, periarthritis circumflexa, nerve paralysis, rheumatism, contusion of shoulder and so on. Similar erroneous diagnoses are very prevalent at the present time. Codman explains these symptoms as being due mainly to an inflammation of the subacromial bursa. In his original paper Codman mentions injuries to the supraspinatus tendon as incidental to injury of the bursa but in his later papers while still regarding the major lesion as being one of bursitis he emphasizes the importance of the supraspinatus injury as part of the picture.

Subsequent writers have followed Codman in ascribing the major lesion to the bursa and the minor lesion to injuries of the supraspinatus tendon. My own limited experience would indicate that the bursal lesion forms the minor feature in these cases and that the injury to the supraspinatus or much more rarely the infraspinatus tendon constitutes the dominant lesion. The supraspinatus tendon is subjected to practically the same pressure as the bursa between the acromion and the humeral head when the arm passes through the arc of abduction. The tendon is subjected to the same violence as the bursa from direct trauma as from a blow or fall on the shoulder. Indeed by the substitution of the word tendon for bursa or bursa and tendon one can adopt Codman's own description of etiology, causation of symptoms and treatment and apply it with about equal force to the tendon as being the primary and essential lesion in all the acute and chronic cases irrespective of whether a deposit is present or not. A sore tendon presumably resents being pinched just as vigorously as does a sore bursa. Partial rupture of the tendon is a necessary prelude to a tear in the bursa when the two co-exist from muscular violence. As between these two injuries the rupture would seem to be the more

serious. Although the bursa is fairly adherent to the tendon yet it seems in some cases that partial tendon rupture might occur without tear of the bursa. Particularly is this true in the cases in which a deposit (which presumably occupies the cavity caused by the rupture) is situated on the deep aspect of the tendon and incisions have to be made through intact tendon fibers before the deposit can be exposed. That was the location of the deposit in two of my cases.

In nearly all carefully observed cases the calcareous deposit has been found both by others and myself beneath the bursa often imbedded within the tendon where it is not in direct contact with the bursa at any point. If these deposits were due primarily to lesions of the bursa it is difficult to understand why many of them are not found in the roof of the bursa. In all of my acute cases removal of the deposit caused immediate cessation of the original pain notwithstanding separate incisions having been made through the roof and the floor of the bursa. If simple tears or contusions of the bursal walls can result in such severe symptoms as these patients suffer then it would seem logical that the immediate effect of the operation should be an aggravation rather than a cessation of symptoms. Notwithstanding the incisions in the bursal wall not having been sutured these patients soon regained their full range of motion. It therefore seems illogical to assume that either bursal contusion or tear is the likely cause for the months or years long duration of symptoms in these patients. The paucity of lesions found in the bursa in my operative cases indicates that but this is an infrequent complication rather than a constant coexistent lesion. I think the evidence at the present time is conclusive that calcareous deposits do not originate either in the bursa or in its walls and that the term calcifying subacromial bursitis is a misnomer.

It is very important for the surgeon to realize that these deposits are not in the bursa but beneath it. One of my surgical acquaintances was unable to find the deposit in three of twelve operative cases shown by the X-ray because he limited his search to the bursa and did not explore beneath the bursal floor.

The treatment of cases of calcareous deposit will depend upon the stage at which patients apply for treatment. I no longer hold my former radical view that all cases of deposit should be operated upon. Accidentally discovered quiescent deposits do not require operation. If a deposit is causing acute agonizing pain its removal affords the most prompt and most certain method of relief and cure. In between these two extremes are individual cases of all degrees of severity of pain and dysfunction of the shoulder and the decision as to operation is left largely to the patient. The more prolonged or more severe the pain or the more serious the shoulder crippling the greater is the need for operation. Awaiting the spontaneous absorption of any given deposit is a very uncertain proposition. Even if it does disappear the symptoms may persist or recur for some months in lessening severity after the deposit has been absorbed. Removal of the deposit in chronic cases can be accomplished very comfortably to the patient under local infiltration anesthesia. (as oxygen anesthesia) should be employed for the hyperacute cases in which the slightest touch or movement causes severe distress and for the chronic cases in which it is necessary to manipulate the shoulder to overcome muscular contractions or to break up adhesions.

The chronic cases with contracted muscles that I have operated on usually came during an acute exacerbation brought on by vigorous efforts at passive motion. In the past I have been unduly influenced by the evil effect of passive motion in causing the acute distress before operation and fearing to add to that distress have refrained from making any very forcible manipulations at operation to overcome the restricted shoulder motion. I think this policy has been a mistake as removal of the deposit invariably has relieved the pain of the exacerbation and forcible manipulations after removal of the deposits are not apt to result in any more pain than they would in any other contracted shoulder free from deposit. It therefore seems advisable to use a fair degree of force to loosen up the contracted shoulders at the time of operation.

The use of excessive force in manipulations of the shoulder or of any other joint is not

justifiable. Excessive force means excessive inflammation, reaction and pain and inability to carry out passive motion over such a long period that the contractures recur. The employment of excessive force in the shoulder may mean fracture of the humerus, dislocation of the shoulder or rupture of the axillary vein. Moderate force by the Sir Robert Jones method of manipulation is frequently sufficient to restore complete range of shoulder motion but if not the surgeon should be satisfied with partial restoration of motion at the time of operation and later secure full range by having the patient use the overhead pulley and rope. Rarely the patient's efforts will not suffice in which event it is better to resort to a second and third manipulation under gas than to use moderate force rather than to use excessive force at the original operation.

Both acute and chronic cases should receive postoperative treatment along the lines previously indicated until there is complete relief from pain, from stiffness of the shoulder and from muscular atrophy.

I have gained the impression in my non-operative cases that the distress in acute cases and the acute exacerbation of symptoms in chronic cases are due to an acute inflammation superadded to the chronic inflammation which originally caused the depo. This acute inflammation with its increased blood supply results in absorption of the deposit irrespective of treatment or lack of treatment. Thus far I have observed absorption of a deposit only after moderately or viciously acute symptoms. Quiescent deposits have neither diminished nor enlarged while under observation. In the cases of calcareous deposits not operated upon, treatment should be directed toward safeguarding the patients from further trauma and keeping them comfortable pending spontaneous absorption. The patients should be instructed to refrain in so far as possible from performing those shoulder motions which their own personal experiences have shown to cause pain. Each time pain is inflicted the underlying lesion is subjected to further trauma with consequent aggravation or prolongation of clinical symptoms.

Intelligent patients soon learn various methods of avoiding pain. For instance an indi-

vidual with a deposit in the right shoulder will transfer many of his activities to his left hand. The pain caused by putting on a coat or overcoat in the usual way can be avoided by complete insertion of the affected arm into the sleeve first. A woman will place her skirt on her right side forearm so as to fasten its button in front and then rotate the skirt into position.

In those cases in which occupational trauma aggravates symptoms it is desirable but seldom possible to have the patients make a temporary change in occupation. The inability of a skilled workman to change his occupation may be a determining factor in favor of operation.

In those patients in whom occupational trauma is due to holding the arms in the abducted position (as in type writers, pianoplayers and machine operators) it will frequently be found that the abduction and trauma can be overcome directly by lowering the level of the machine or by raising the seat or if the patient stands at work by placing a small platform at the base of the machine. This absolute or relative lowering of the machine level automatically brings the elbows closer to the sides of the chest and thereby removes the abduction element as a cause of the trauma.

Active abduction by increasing the strain on the inflamed supraspinatus tendon increases pain. Passive abduction to an angle of about either 60 or 120 degrees or rest in abduction at about the same angle relieves the pain by relieving the strain on the supraspinatus. Abduction whether active, passive or at rest between 70 and 95 degrees of angulation increases pain by compressing the tendon between the acromion and the tuberosity of the humerus. Rarely a patient learns by his own experience that wide abduction as obtained by tying his wrist to the bed head or resting his hand under his head gives relief at night. Many surgeons endeavor to treat their patients by holding the arm at the 120 degree angle on various forms of splints or plaster casts or by tying the forearm or wrist to the head of the bed. This position shortens the duration of acute symptoms but it is so uncomfortable that I have abandoned it as the patients were prone to consider the treatment

worse than the disease. A 40 to 60 degree angle of abduction can be obtained at night by resting the arm and forearm on a pillow which is placed with one end on the mattress and the other end over the patient's chest and abdomen. The same position is obtained by day while sitting by resting the arm on a pillow which is placed on the arm of a chair and across the lap or on top of a table. Sedatives may be required to procure sleep at night. If pain is so great as to require morphine operation should be urged instead.

Physiotherapy in its various forms may be helpful but if used injudiciously may cause marked aggravation of symptoms. Several of my chronic operative cases first came under observation during an acute exacerbation immediately following vigorous massage and passive motion by physiotherapists. Gentle massage combats the tendency to atrophy and may relieve pain but it should not be employed directly over the tender area. Heat in its various forms commonly ameliorates the pain. Many patients find that an electric pad applied to the shoulder at night is a sleep producer. Harris claims to have cured cases of calcareous deposit by diathermia. He apparently refers to symptomatic cures only as he did not follow up his cases by x-ray

examinations to determine whether the deposits had been absorbed. I have tried diathermia but am not convinced that it or any other form of treatment has any specific effect in causing absorption of deposits.

The tendency toward the formation of adhesions and the contracture of muscles must be overcome by early and daily resort to full abduction of the shoulder. This can be accomplished painlessly by having the patient stand with knees extended and touch the floor with his finger tips.

Recurrence of a deposit is a reasonable possibility but thus far I know of no instance in which one has recurred after having been either absorbed or removed by operation.

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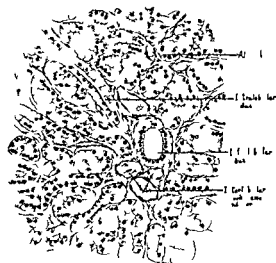


Fig 1 Section of pancreas show giant lobules with vessels nerve and duct and surrounding tubular al coil

creatic infection between the duodenum and the converging ducts of Santorini and Wirsung. They attribute the chronic infection to a lymphatic origin. If the infection ascends the pancreatic ducts the induration should be more general. The lymphatics from the gall bladder drain to Desjardins' triangle of pancreatic infection (6) as has been demonstrated by Franke (idem). Deaver reported 70 patients with chronic pancreatitis at the Lankenau Hospital 72.91 per cent showed evidence of biliary infection 42.53 per cent had calculi while 30.38 per cent showed a non calculous

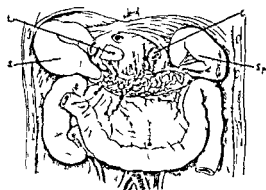


Fig 2 The relation of the lymphatics of the human pancreas to the regional lymph nodes. S Stomach turned to the right C Crura L stump of liver Sp spleen

inflammation. W. J. Mayo (1) reports that 90 per cent of the cases having acute and chronic pancreatitis have been operated upon for infected gall bladders usually with gall stones. Mann and Ciordano (11) working experimentally on goats doubly ligated the common bile duct and divided it at its entrance into the duodenum. The animals lived from 1 to 30 days. In none was there either macroscopically or microscopically an area with the appearance of acute hemorrhagic pancreatitis. The results of these experiments emphasized first that with the pancreatic duct emptying directly into the common bile

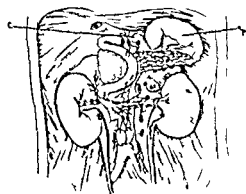


Fig 3 The relation of the lymphatics of the human pancreas to the thoracic lymph nodes. C Crura Sp spleen (From Franke)

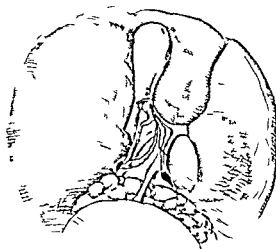


Fig 4 The relation of the lymphatics of the human pancreas to the thoracic lymph nodes (From Franke)

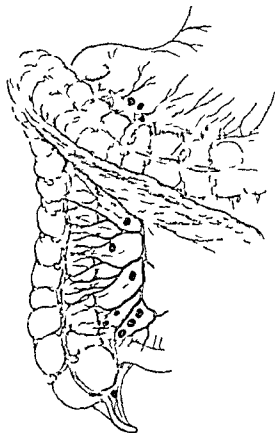


Fig 5 Shows pyloric constriction anastomosis (From Braithwaite)

duct and the latter completely obstructed bile was not forced into the pancreas except after a considerable length of time second that bile did pass into the pancreatic duct and infiltrate the pancreas completely when under the maximum of pressure which the physiological mechanism of the animal could produce. Acute hemorrhagic pancreatitis was not seen. From the data on the relation of the duct of Wirsung to the common bile duct which is shown in Figure 8 it is anatomically possible for obstruction existing at the ampulla to convert the two ducts into a continuous channel and allow bile to pass in the pancreatic duct in 35 cases.

Sweet (16) in working experimentally on dogs has been able to remove a portion of the pancreas and join the head of the pancreas or

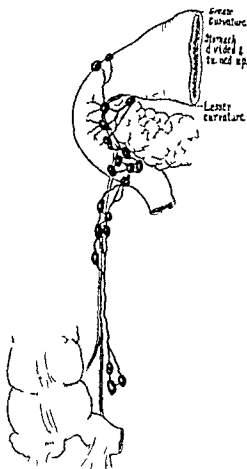


Fig 6 Diagram showing arrangement of gall and bile ducts in the 11 g subject from a leucocytic disease (From Braithwaite)

the duct to the intestine without danger of pancreatitis either acute or chronic for as long as 11 months interval. From this it would not seem that infection ascends by way of the duct.

Liggers (7) gives two possible causes of acute pancreatitis first that symptoms are due to infection or ferment action due to the entrance of bile or duodenal contents into the pancreatic duct second that it is an infection carried to the pancreas by means of the lymphatics. He leans to the theory that infection as such has nothing or little to do with acute pancreatitis but that it is due to the action of



Fig 7 Drawing of an injected postmortem specimen (the whole specimen in an ileocaecal gland). Retrograde flow back to the cecum will clearly show (from B. Thwait)

the liberated pancreatic ferments on the surrounding tissues. In 6 cases reported by him 5 had gall stones and the sixth had a cholecystitis.

From the above data on the lymphatic drainage of the pancreas it would seem that the gall bladder and biliary system are the primary factors in producing chronic infection within that area. The appendix and ileocaecal angle play the second rôle as they have direct connection with the pancreas as demonstrated from the work of Braithwaite, Craig and MacCarty (4). The acute symptoms are presumably due to a setting free of the trypsinogen from the acini cells and the transformation of the trypsinogen into trypsin through the bacterial action.

#### PATHOLOGY

Chronic pancreatitis involves the interstitial tissues and the increased connective tissue is usually confined to the head of the pancreas. From Figure 8 one sees an increase in the

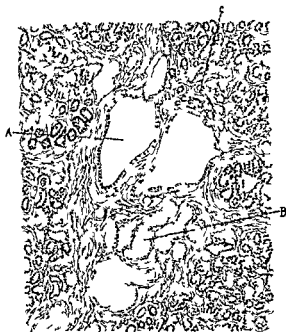


Fig 8 Section from a fibrosed pancreas showing a combination of centrilobular and perilobular types. There has been obstruction and dilatation of the main ducts A and the branches B. The lobules are separated by broad perilobular bands of fibrous tissue and the individual acini C in the lobules are similarly separated by a centrilobular fibrosis. (From Adams and McCrae)

fibrous tissues separating the lobules and also the individual acini of the lobules. Adams and McCrae (1) state that it is to be remembered that in cases of cholelithiasis we encounter frequently a marked induration especially of the head of the pancreas thus becoming so firm that the surgeon is apt to mistake it for a new growth. The clinical and pathological data would indicate that the head of the organ is most frequently affected from chronic infections.

#### SURGICAL ANATOMY

Due to the location of the pancreas the anatomical approach to the organ is rather difficult. In surgical conditions of the pancreas the relation of the organ to the duodenum, the common bile duct, the left kidney and spleen renders it rather difficult to make a clinical diagnosis of pancreatic involvement. Figure 9 shows the relation of the pancreas to the neighboring organs.



TABLE I.—DATA ON THE RELATION OF THE DUCT OF WIRLINC TO THE COMMON BILE DUCT

Group	Location of duct	Time of onset	Time of cessation	Time of cessation	Time of cessation	Time of cessation	Time of cessation	Time of cessation	Time of cessation
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9
10	10	10	10	10	10	10	10	10	10
11	11	11	11	11	11	11	11	11	11
12	12	12	12	12	12	12	12	12	12
13	13	13	13	13	13	13	13	13	13
14	14	14	14	14	14	14	14	14	14
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16	16	16	16	16	16	16	16	16	16
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47	47	47	47	47	47	47	47	47	47
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97	97	97	97	97	97	97	97	97	97
98	98	98	98	98	98	98	98	98	98
99	99	99	99	99	99	99	99	99	99
100	100	100	100	100	100	100	100	100	100

## THE SYMPTOMS OF CHRONIC PANCREATITIS

We are referring to the acute exacerbations of upper abdominal pain that occur in patient following cholecystectomies and the attacks are more or less similar to those that the patient had previously experienced. These recurrent attacks are usually met with within the first few weeks or months following the cholecystectomy.

## PAIN

This is the chief complaint of the patient and the individual is usually seized with a severe upper abdominal pain which is constant in character. It is difficult for the patients to localize the pain. Occasionally they say it is in the right upper quadrant and radiates to the back. More frequently they state that the pain is on the left side in the region of the left kidney. Due to its location on the left side it would make one suspect a renal calculus. The intensity of the pain will vary in different individuals presumably depending upon the severity of the pancreatic involvement. The attacks may last from a few hours to 48 or 72 hours. If the pain is located in the left kidney region at the beginning of the attack it quite frequently localizes itself in the upper abdomen in the middle of the epigastrium after 48 hours or so. The patients usually feel normal within a few hours after the pain subsides. Nausea is not commonly

seen in this condition. Vomiting is usually encountered and it comes on approximately within the first hour of the pain and usually persists during the attack. They may vomit as many as 40 to 50 times within 24 hours. The vomitus is clear or lightly bile tinged and is non-offensive. Because of the persistent vomiting and the sudden attacks of abdominal pain one often suspects a high intestinal obstruction but the general appearance of the patient is not that of one suffering from an intestinal obstruction and in spite of the severe pain and persistent vomiting the general appearance does not indicate that the patient is critically ill. Jaundice is quite frequently encountered in the severe cases particularly after they have been incapacitated for 48 to 72 hours. This is presumably due to a compression of the bile duct as a result of the swelling of the head of the pancreas. According to Helly (9) the common duct passes through the head of the pancreas in approximately 6 percent of cases. Mayo Robson (14) believes that some of the cases of extrahepatic jaundice may be due to a mild pancreatitis.

## PHYSICAL EXAMINATION

The abdomen is usually not distended and does not have any marked rigidity but the patient complains of more or less indefinite tenderness over both upper quadrant and frequently in the costovertebral angle more frequently on the left than on the right side. Egan was impressed with the lack of physical signs as compared with the severity of the symptoms in his case. In two of his patients the house staff ventured to state that they were simply neurotic. The temperature is usually normal but when elevated it is around 100 degrees F. The blood examination in the milder cases will reveal a normal leucocyte count or only a very slight increase in the total count as well as the polymorphonuclear leucocyte. The urine analysis is negative.

## DIAGNOSIS

The diagnosis of this condition can only be made by the process of elimination and one must exclude renal calculus and bear in mind the probability of a stone in the common duct which was overlooked at the original opera-

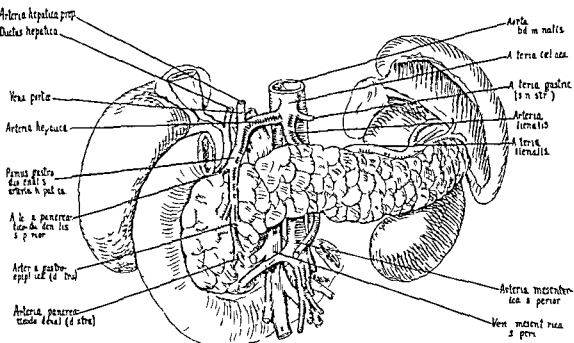


Fig. 9. The pancreatic ducts and their blood supply to the abdominal organs (From Sherris)

tion. In the severer forms of this condition it is sometimes impossible to make a diagnosis without an exploratory laparotomy. In the milder types of infection one should suspect the pancreas as the cause of the trouble and advise keeping the patient under observation. In Judd and Burden's series the findings after an exploratory laparotomy were pancreatitis in 17 out of the 4 cases. The common bile duct was patent in all.

#### TREATMENT

We should not be too anxious to explore cases that have recurrent symptoms within the first few weeks or months after having had cholecystectomies performed. Some of these cases subside and are permanently cured without further surgical intervention, presumably having removed the primary focus of infection the pancreatic involvement gradually subsides.

The cases that are explored for calculi in the ducts and which are negative continue to have recurrent attacks similar to the ones preceding the laparotomy. Common duct drainage does not seem to have any cura-

tive effect on the condition and does not prevent subsequent attacks. W. J. Mayo says it would appear that as a result of our early postmortem knowledge and tragic experience with an acute pancreatitis we have been inclined to underestimate the ability of the tissues concerned to localize or cure a large number of acute pancreatic inflammations. This seems to hold true in the recurrent attacks of pain following cholecystectomies which in a certain percentage of cases can be attributed to a pancreatic involvement. We should let Nature have its chance to effect a cure.

#### CONCLUSIONS

1. Some of the recurrent attacks of upper abdominal pain following cholecystectomy seem to be due to acute exacerbation of a chronic pancreatitis.

This diagnosis should be arrived at by a very careful process of elimination.

3. Some of these cases spontaneously cure themselves if given the opportunity.

4. Surgery employed in these cases does not seem to cure the condition or prevent subsequent attacks.



A MANOMETRIC STUDY OF THE CEREBROSPINAL FLUID IN SUSPECTED SPINAL CORD TUMORS<sup>1</sup>

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**S**PINAL cord neoplasms whether intramedullary, intradural or extradural sooner or later obstruct the free subarachnoid space and interfere with the circulation of the cerebrospinal fluid. Hence a study of the circulation of this fluid should give data of value in determining the presence or absence of spinal cord neoplasms by far the commonest form of subarachnoid block.

It has long been known that compression of the veins of the neck by interference with the venous intracranial outflow causes a rise of intracranial pressure and secondarily cerebrospinal fluid pressure. Also straining blowing the nose coughing or deep breathing etc. increase the cerebrospinal fluid pressure.

When a manometer is attached to a needle in the lumbar sac and the veins of the neck are compressed an instantaneous rise of the fluid in the manometer takes place. Queckenstedt<sup>2</sup> called attention to the fact that when the subarachnoid space is obstructed the normal rise which follows compression of the veins of the neck does not take place.

In order to determine the clinical value of manometric studies of the cerebrospinal fluid the present investigation was begun in 1921 on the clinical material of the New York Neurological Institute.<sup>3</sup>

Since then we have studied the manometric readings in more than 50 patients with suspected spinal cord tumors and in others in whom spinal cord tumor was not suspected. Where spinal cord neoplasm was suspected the pressure study was made by lumbar puncture alone for our aim has been to make the lumbar puncture alone yield as much data as possible and to determine the value of such data in the diagnosis of spinal cord neoplasms.

We felt that a thorough manometric study of the cerebrospinal fluid through the lumbar puncture alone had not as yet been made and that this might enable us to determine the indications for combined lumbar and cistern puncture as advocated by Ayer.<sup>4</sup> When the single puncture does not give sufficient data to permit of an accurate determination being made we strongly recommend the very excellent procedure of combined cistern and lumbar puncture so skillfully used by Ayer and his co-workers. In this series of cases of suspected spinal cord tumors the lumbar puncture alone has yielded sufficient data to permit of definite conclusions being drawn in all excepting three. In only these 3 did we find that combined cistern and lumbar puncture was indicated.

We wish to emphasize that manometric studies of the cerebrospinal fluid do not relieve the neurologic surgeon of making a thorough careful neurologic examination. It is only one part of the neurologic examination. On the other hand we do not feel that the neurologic examination is complete in any patient in whom a spinal cord tumor is suspected unless a thorough manometric study of the cerebrospinal fluid has been made.

The mechanism causing an increase in intracranial pressure in compression of the veins of the neck differs from that brought into play by straining coughing blowing the nose or deep breathing etc. Straining coughing and blowing the nose cause a rise in intracranial pressure as well as in intrathoracic and intra-abdominal pressure. The intra-abdominal and intrathoracic pressure causes a rise in the intraspinal pressure by interference with the vertebral and spinal venous circulation while

<sup>1</sup> Zur Diagnose der Rückenmarkstumoren. Dtsch. Zsch. f. Nervenheilk. 96:135.

<sup>2</sup> W. Queckenstedt, Über die Bedeutung der Liquor-Druckmessungen bei der Diagnose der Rückenmarkstumoren. Dtsch. Zsch. f. Nervenheilk. 96:135.

<sup>3</sup> Zur Diagnose der Rückenmarkstumoren. Dtsch. Zsch. f. Nervenheilk. 96:135.

<sup>4</sup> Ayer, J. B., in: The Lumbar Puncture, with special reference to the diagnosis of spinal cord tumors. New York, 1914.

<sup>5</sup> D. M. Frantz and H. R. Merwarth, Dec. 1921.

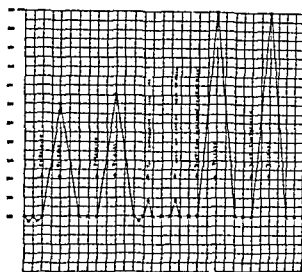
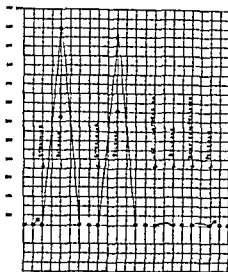


Fig. 1 (ft) Manometric chart (F V H N 27,454) showing complete barachin block. A rise of cerebrospinal fluid pressure occurred on deep inspiration of the neck whereas a marked rise occurred on strain. This chart shows that there is a dual mechanism of rise in the rise of cerebrospinal fluid pressure. Compression of the veins of the neck against intra-

cranial pressure (ft) transduced rise in intraspinal pressure (F V H N 27,454)

Fig. 2 (ft) A typical normal manometric diagram of the spinal fluid seen in this chart (N 27,75) showing normal respiratory and pleural oscillations. Prompt rise and fall to high pressures on straining and on deep inspiration.

compression of the veins of the neck interfere with the cerebral venous outflow.

In a normal individual in whom a free subarachnoid space exists straining, coughing, blowing the nose, etc., cause a rise in the cerebrospinal fluid pressure due to pressure exerted upon the fluid in both the cranial and spinal chambers while compression of the veins of the neck causes an increase due to an increase in intracranial pressure primarily. This point of difference in the spinal and cranial mechanism of pressure increase is of value in interpreting the manometric readings in cases of spinal cord neoplasm. In some instances where complete subarachnoid block existed we found a marked rise of the cerebrospinal fluid pressure on straining and coughing but no rise on compression of the veins of the neck. Such a chart is shown in Figure 1 in a patient having a spinal cord tumor verified at operation. On compression of the veins of the neck intracranial pressure was increased and transmitted to the cerebrospinal fluid above the tumor. Due to block caused by the tumor this rise in intracranial and spinal fluid pressure

above caused no rise in pressure in the fluid below the tumor consequently no rise in the manometer in communication with the lumbar sac. However on straining or coughing or deep breathing, etc., without compression of the veins of the neck, a marked rise in the fluid in the manometer took place. Since no rise took place on compression of the veins of the neck which we know increased intracranial pressure above the tumor and since a rise took place on straining or coughing which increased both intracranial and intraspinal pressure we may deduce that the rise obtained was due to a rise in intrathoracic and intra-abdominal pressure transmitted to the cerebrospinal fluid below the tumor. Such a result shows well the dual mechanism involved.

Experimentally it was found that when the veins of the neck were ligated in the cat a rise in cerebrospinal pressure took place similarly when the vena cava inferior was ligated without ligation of the veins of the neck a rise also took place showing that either mechanism is effective in producing a

change in cerebrospinal fluid pressure. However the rise in the cat is much slower and not as immediate as in the human. This difference may be due to mechanical factors present in the human and not in the cat. Simultaneous compression of the veins of the neck and the vena cava inferior caused a more rapid rise than compression of either of them alone. By simple compression of the veins of the neck in the cat without exposing them the cerebrospinal fluid pressure rose but to a lesser extent than when abdominal pressure was applied. Abdominal pressure evenly distributed was applied to the abdomen by using a blood pressure cuff and a blood pressure apparatus and caused a greater rise in cerebrospinal fluid pressure than jugular compression.

In our earlier clinical work we tried coughing, blowing the nose and deep breathing but found that these were such variable quantities that comparison could not be made. Many of the patients when told to take a deep breath did not seem to know what was meant and instead of taking a deep breath merely threw out their chests and held their breath. Like wise when told to blow their nose the action and effort expended in the act varied to such an extent that no common factor could be said to exist and consequently comparisons could not with fairness be made. However straining as if at the stool brought forth in all an effort somewhat more uniform and while we have had no means of measuring the force exerted the manometric readings have been sufficiently alike to permit of comparison being made. To increase the spinal fluid pressure through combined intracranial, intrathoracic and intra abdominal pressure we have discarded consequently the other methods of coughing, blowing the nose and deep breathing in favor of straining. The procedures used therefore were straining and compression of the veins of the neck.

#### COMPRESSION OF THE VEINS OF THE NECK

We have found that two types of compression of the veins of the neck may be used: one firm pressure sufficient to cause cyanosis of the face and second extremely light pressure which we have called touch compression.

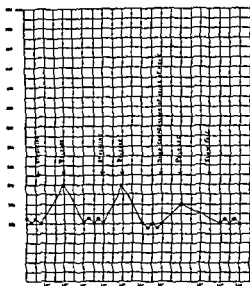


Fig. 3. Manometric chart (P. S. No. 26393) showing complete subarachnoid block. On deep pressure of the veins of the neck no rise was obtained yet on straining a light rise occurred.

The value of the latter type of pressure we have only lately become aware of and find it of even greater value than the heavier form of compression.

In a normal individual light touch compression will give rise to an immediate fluid wave and cause an appreciable rise in the manometer of from 10 to 30 millimeters without evoking any straining reaction. The latter causes a rise in intra abdominal and intrathoracic pressure and introduces additional factors in the pressure mechanism. Straining or defense reactions may cause a rise of cerebrospinal fluid pressure below the tumor and unless guarded against such a rise may be interpreted as the result of compression of the veins of the neck. By touch compression this straining element is not invoked and the results are those of pure compression of the veins.

The extreme delicacy of touch compression makes it a very sensitive test and we believe that it will prove to be of more practical service than the deeper form of pressure or in any case a valuable adjunct to the deep form of pressure.

When firm pressure is applied to the deep veins of the neck and maintained over a period

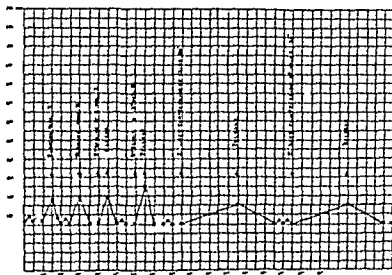


Fig. 4. Manometric chart (H. N. 2752) showing complete relaxation of the neck with the use of a low retensional force of 1 mm Hg.

if from 5 to 10 seconds a great rise in the cerebrospinal fluid pressure takes place. It is conceivable that this may be sufficient perhaps to drive the fluid past a beginning complete obstruction whereas when light pressure is exerted momentarily the fluid would be less apt to be driven past a block. Consequently touch compression may be considered more delicate.

When deep pressure of the veins of the neck is exerted co-operation of the patient must be gained and considerable care used to prevent coughing, holding the breath or straining. Normally when firm pressure is applied to the veins of the neck an instantaneous and continuous rise of the cerebrospinal fluid in the manometer takes place. Within 10 seconds or less the fluid should rise approximately to 500 millimeters and as soon as the pressure is removed an instantaneous and continuous fall should take place such as is seen when the stop cock of a burette is opened. The fall is generally as prompt as or more prompt than the rise. Ten seconds or less may be taken as the normal time for the rise and for the fall. We consider the time element almost as important as the pressure reading.

A typical normal manometric reading of the spinal fluid is seen in Figure 2. The technique which we have now adopted as standard is as follows. The patient is placed on his side in a horizontal position and made as comfortable as possible. After lumbar puncture a period of 3 to 5 minutes is waited to permit the patient to overcome any pain or fear which may have a tendency to prevent the establishment of the normal level. As soon as complete relaxation is obtained the reading of the cerebrospinal fluid is made. This we have termed the stabilized level. Normal pulse and respiratory oscillations of 1 to 3 millimeters are usually noted.

Each step to be done then is explained to the patient in detail and he is told to do nothing in anticipation of any command until that command is given—not to move or strain—to do nothing except remain perfectly quiet until he is told precisely what to do. Unless this is explained the patient frequently anticipates the command and begins to move toward its execution whereas the execution should be sudden and its duration timed. The patient's co-operation is more readily obtained when he understands in advance what is expected of him.

Touch compression is then exerted over the jugulars. This type of pressure consists of little more than placing the fingers gently over the jugular veins and exerting a moment's pressure. When the fingers are placed over the jugular veins an immediate and instantaneous rise of 10 to 30 millimeters is seen in the manometer. The presence of such an immediate and instantaneous wave generally foretells negative manometric readings in the remaining phases of the manometric tests.

The next step is to have the patient strain as if he were at the stool straining for 10 seconds. This causes a marked continuous and steady rise of 200 to 500 millimeters. A wide variation exists in this test due in the main we think to the variation of the force exerted; consequently we consider the facts gained to be of not too great significance, but at times valuable for example when a marked rise takes place on straining with no rise on compression of the veins of the neck such as has been shown in Figure 1. At one time we thought that in those cases in which no rise occurred on compression of the veins of the neck the result of straining might point to a localization of the block, i.e. a small rise might tend to point to a block below approximately the mid thoracic region and a considerable rise to a block above this level. This difference on straining was thought to be due possibly to the fact that in a sac shut off below the mid thoracic level little fluid and a short column would exist below the block and consequent pressure on the short column would cause little rise; conversely when pressure was exerted over a longer column with a greater amount of fluid in high placed block the rise would be greater. While this may perhaps be true theoretically it was not found to be true in practice in this series of manometric readings.

Our next step is to apply firm pressure over the veins of the neck. As a technical procedure we have found it best to pass the hands around the side of the neck from behind holding the palm and fingers flat and avoiding the trachea so as to interfere as little as possible with breathing. With a little practice pressure can be exerted without causing the patient to strain or cough. By elimination of

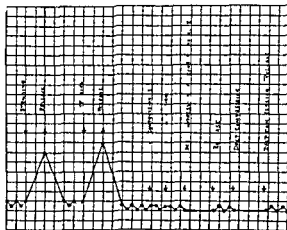


Fig. 5. Manometric chart (S.G. No. 27750) showing complete subarachnoid block. Essentially the same as Figure 4. The compression of the neck immediately following the fall requiring approximately 10 seconds for the rise.

straining and coughing a more nearly pure compression of the veins of the neck is effected thus avoiding factors introduced when intrathoracic or intraabdominal pressure is invoked which as has been said may complicate the picture. Pressure is exerted for 10 seconds. The rise of the fluid in the manometer should be instantaneous and continuous, approximately to 500 millimeters or more and recession likewise immediate and uninterrupted when the pressure over the veins is removed.

As a rule all steps are done twice to lessen the possibility of error and in some instances the second compression of the veins of the neck will bring out manometric changes not revealed in the first.

In our series of cases no *extradural* or *extramedullary intradural* tumor was found in any patient in whom a manometric test negative in all phases was recorded. To this rule there was no exception. However in one patient having an *intramedullary tumor* of the conus a completely negative manometric test was found. In this patient the neurologic examination pointed to a very definite intramedullary tumor of the conus. At operation a very slight symmetrical enlargement of the conus showing a slightly harder consistency was seen and a presumptive diagnosis of intra



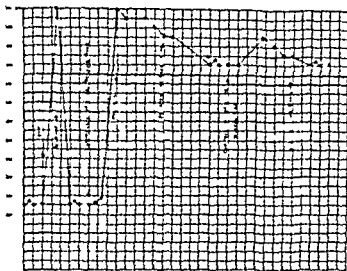


Fig. 6. Manometric chart (No. 27) showing line graph of intracranial pressure. On deep compression of the left neck a prompt rise followed by a hanging fall and the establishment of a new level 100 mm Hg. It is rather than a small fall. See note in text. The neck was released five from the new level and a hanging fall. A prompt rise followed by a hanging fall. See Fig. 1.

medullary glioma was made. The rather slight symmetrical enlargement of the cord in this patient did not obstruct the free subarachnoid space. In view of this experience we must therefore consider that intramedullary tumors which give rise to symmetrical enlargement of the cord may in their early stages present completely negative manometric readings.<sup>1</sup> Such is to be expected from the mechanical factors present in a slight symmetrical enlargement of the cord in this region. Since no type of stricture or obstruction was present with an apparently free circulating fluid we feel that examination of the fluid at different loci would not have revealed any noteworthy difference in the fluid from different levels particularly since the lumbar fluid did not show any globulin and only five cells.

#### MANOMETRIC TESTS INDICATING COMPLETE BLOCK

In all of the patients in whom manometric findings indicated complete block definite

more than five cells in the lumbar fluid. In the cisterna magna the fluid was clear and contained no cells.

obstruction of the subarachnoid space was found in those operated upon (Fig. 1). In this group of 14 patients showing positive manometric findings two refused operation and consequently are uneventful. However the neurological examination left little doubt as to the diagnosis. In the remaining 12 operated upon neoplasms were found in 11 and in the twelfth an extradural tubercular cyst was found blocking the subarachnoid space and compressing the spinal cord quite the same as if it had been an extradural spinal neoplasm. Thus in all cases of this group verified by operation of obstruction of the subarachnoid space was confirmed.

This evidence of obstruction of the free circulation of cerebrospinal fluid was however further substantiated by the fact that in each instance a marked globulin increase was noted. Xanthochromia was present in five. Xanthochromia without a marked increase in the globulin content was not seen but a marked globulin increase without xanthochromia was common. In view of the opinion held by some that xanthochromia is not found in intramedullary tumors it is inter-

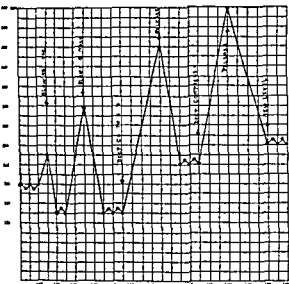
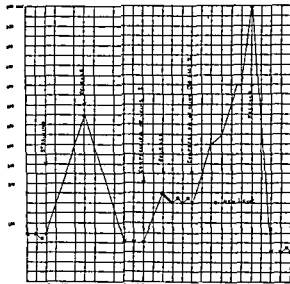


Fig 7 (1 ft) Manometric chart (No. 26,431) showing in complete subarachnoid block Type 1. Prompt rise on compression of the veins followed by prompt fall with the establishment of a new level 60 millimeters higher than the original. On second compression of the veins of the neck a prompt rise and a slower fall took place followed by the establishment of another level 40 millimeters higher.

Fig 8 Manometric chart (No. 27,642) showing in



complete subarachnoid block Type 2. On compression of the veins of the neck a rise of approximately 100 millimeters took place with the establishment of a new level 60 millimeters higher than the original level. On second compression of the veins of the neck a regular and labored rise requiring 30 seconds took place followed by a prompt fall approximately to the original level.

interesting to note that in both intramedullary tumors in this series xanthochromia was present.

In reviewing the neurologic examination of the patients in whom complete subarachnoid block was found we feel that the diagnosis could have been made from the neurologic examination alone by any one with experience in the clinical course of spinal cord neoplasms. Irrespective of the manometric findings. The manometric findings merely offered confirmatory evidence in support of the diagnosis. Since lumbar puncture must in any event be done it is of course reassuring to have further evidence in support of the diagnosis especially when such evidence can be so readily obtained. We feel that when positive manometric findings are obtained through lumbar puncture no further information of additional value can be gained from combined cistern and lumbar puncture. A typical positive manometric chart is shown in Figure 3. We have found that the positive charts indicating complete block follow approximately two types namely one in which compression of

the veins of the neck causes no rise at all or essentially no rise and second one in which the rise on compression of the veins of the neck is minimum—seldom more than 50 to 60 millimeters. It has been difficult to determine whether or not the minimum rise in this latter group is really due to compression of the veins of the neck or to straining or holding the breath which in some patients is apparently an unavoidable association. Practically this slight rise is of little significance since such manometric reading can in no wise be confused with the decidedly marked rise found when no obstruction exists. Occasionally the slight rise associated with compression of the veins of the neck is sustained a minute or more recession being extremely slow and irregular at times not to the old level but a new one 10 to 20 millimeters higher.

The pressure readings in the group of complete subarachnoid block are shown in Table I. The average initial pressure in the group of complete subarachnoid block was found to be approximately 90 millimeters and the average pressure on straining 210 millimeter—a







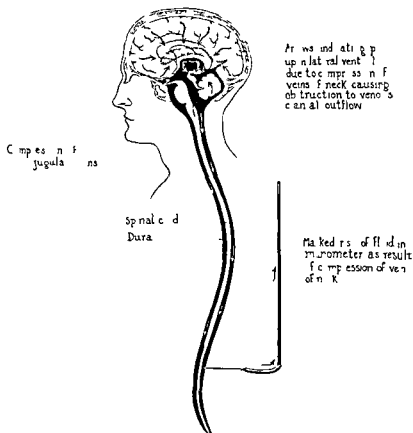


Fig. 11. Schematic drawing showing mechanism of increase in the cerebrospinal fluid pressure. A marked rise in intracranial pressure takes place when the venous canal is obstructed by compression of the veins of the neck. The cerebrospinal fluid is forced out of the canal into the spinal subarachnoid space using manometer in the manometer in connection with the lumbar puncture.

great help in determining the presence or absence of incomplete block, and in influencing the conclusion for or against exploratory laminectomy.

In reviewing the neurologic examinations alone we found that of the 13 cases included in this group in 6 the diagnosis of subarachnoid block seemed warranted without manometric tests; the latter tests in the main serving as confirmatory evidence in support of the presumptive diagnosis. From this standpoint such evidence is of course reassuring as an additional factor indicating the advisability of an exploratory laminectomy.

In four of the group showing incomplete block the diagnosis was established by the manometric examination; the neurologic ex-

amination having failed to give sufficient evidence to warrant the presumptive diagnosis of subarachnoid block. One of these patients showed essentially a cervical root syndrome without any definite signs of cord involvement. Had it not been for the manometric examination we feel that the operation on this patient might have been postponed until more advanced signs had manifested themselves. However in view of the manometric examination a more positive stand could be taken and operation was performed. A very large fusiform enlargement of the cord presumably an intramedullary tumor was found. A needle inserted into the cord showed yellow fluid which coagulated almost immediately.

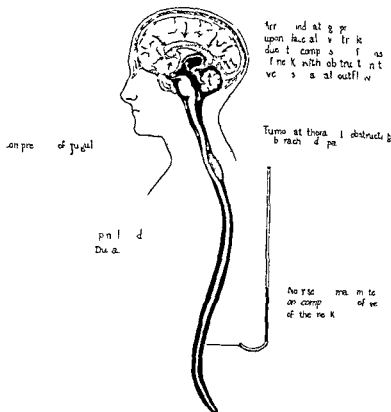


Fig. Schematic drawing showing the location of the tumor at the thoracic level of the spine, showing the brain, spinal cord, and the tumor's position relative to the vertebral column.

Without the manometric tests we feel that most of the patients in this group may not have been explored until a later time when perhaps the chances for complete return of function would have been materially lessened. We recall vividly the history of a patient now in the Neurological Institute in whom a spinal cord tumor readily removable was taken out years after his first presentation to the staff conference. While spinal cord tumor was considered at the first presentation years previously sufficient neurologic evidence was not available to warrant an exploratory laminectomy. No manometric test had been done and to this extent the neurologic examination was incomplete. Had manometric readings been taken we feel that evi-

dence would have been gained which would have warranted an exploration in spite of the incomplete neurologic findings. This patient was lost track of for years and on return for examination marked evidence of spinal cord tumor was present but so great a destruction of the cord had occurred that in spite of removal no return of function has taken place.

In an additional series of three of this group showing incomplete block both the neurologic and manometric examination left the diagnosis still in doubt. While the manometric change were suggestive of incomplete block the evidence was so slight that the diagnosis of incomplete block was considered too doubtful to warrant an exploratory laminectomy.

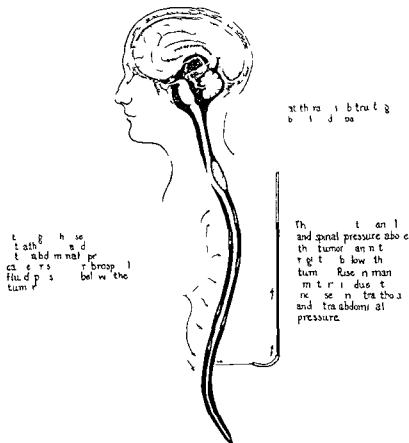


Fig 3 Schematic drawing showing how a tumor in the cervical spinal fluid pressure the presence of a subarachnoid block. Strain gauge is marked in the cranial intracranial fluid pressure consequent to a rise in the cerebrospinal fluid pressure in the neck. However, when a block is present, the rise in the fluid pressure in the neck is not transmitted to the lumbar fluid pressure. The schematic diagram shows the effect of the intracranial pressure on the cerebrospinal fluid block in the tumor.

When the manometric readings are only slightly suggestive and the neurologic examination is also indefinite we feel that combined cistern and lumbar puncture is definitely indicated. Of the 50 cases of suspected spinal cord neoplasms included in this study we have felt that combined puncture was indicated in only these three. Our opinion is that combined puncture should be reserved for those cases in which both the neurologic examination and manometric reading are indefinite. Combined lumbar and cistern puncture certainly is not indicated in those

cases in which frankly negative manometric tests in all phases are found. Combined puncture certainly is not indicated in those cases in which a frankly positive manometric test is found. Nor is combined puncture indicated in the other intermediate group in which definite evidence of incomplete block is gained by the manometric examination. But on the other hand combined puncture is definitely indicated in the remaining very small group in which neither the neurologic nor the manometric examination frankly results in neither completely negative findings



nor those indicating complete or incomplete block. In this *subgroup* of those thus suspected of having *incomplete* block we feel that the greatest help is to be gained by a combined cistern and lumbar puncture as advocated by Ayer and his co workers. Manometric charts indicating incomplete block are shown in Figures 6, 7, 8.

We have attempted to group the various incomplete charts into five types but the distinction between each can not be too sharply drawn. The first three types and variations of them we feel are indicative of incomplete block but types 4 and 5 are distinctly less suggestive. In the latter two types the diagnosis of incomplete block should therefore be confirmed by combined puncture before recommending exploratory laminectomy.

#### CONCLUSIONS

1 In suspected spinal cord neoplasms manometric readings of the cerebrospinal fluid through lumbar puncture should be a routine procedure. Examination is incomplete without a manometric study.

2 Manometric studies of the cerebrospinal fluid through lumbar puncture (without cistern

puncture) may indicate complete subarachnoid block, incomplete subarachnoid block, or the presence of a free unobstructed subarachnoid space.

3 In all patients operated upon in whom the manometric tests indicated *complete* subarachnoid block, some form of spinal cord neoplasm was found.

4 In all patients in whom the manometric tests indicated *incomplete* subarachnoid block, either a spinal cord neoplasm or some other form of subarachnoid block was found.

5 Negative manometric readings were found in two patients having an early symmetrical enlargement of the cord, presumably an intramedullary tumor which however did not interfere with the free circulation of the cerebrospinal fluid. In all others exposed the manometric findings were substantiated at operation.

6 Combined lumbar and cistern puncture is indicated when manometric studies through the lumbar puncture alone do not permit of definite conclusions being drawn. In our experience combined lumbar and cistern puncture was indicated in only 3 cases out of 50 suspected spinal cord tumors.

RADIATION THERAPY IN DEEP SEATED MALIGNANT DISEASE<sup>1</sup>

BY G. C. PFAHLER, M.D., PHILADELPHIA

**R**ADIATION therapy in malignant disease was at first used only on the recurrent and the hopelessly inoperable cases. In some of these striking effects were obtained. Gradually more and more of the primary superficial cases were referred for treatment until now radiation is the method of choice in the treatment of the superficial and non-infiltrating carcinoma.

Likewise in deep seated malignant disease only the recurrent metastatic or hopelessly inoperable cases were originally referred for treatment. Many of these have shown striking results and some have shown permanent recovery. This has established confidence and gradually the entire profession is recognizing the value of radiation. More and more primary deep seated malignant disease is being subjected to radiation early.

The recognition of radiotherapy is national and international as is indicated by the fact that no hospital is today considered fully equipped unless the radiological department is prepared for both superficial and deep radiotherapy. The American College of Surgeons in its last report states: "Superficial and deep therapy is advisable when possible and practical. Supervision through a medical roentgenologist is essential." Ewing very properly says: "The rapid adoption of radiotherapy must stand as evidence of the intellectual honesty of the medical profession." Yet there is still an undercurrent of antagonism which reaches the public with much force greatly impeding progress. Interference with the spread of knowledge retards the acquisition of equipment and prevents many from receiving the benefits now available.

The fact that so much progress has been made in the short period of 25 years indicates that the value is inherent in the radiation. While most of the advance work has been done by men who have literally devoted their lives and entire energies to the subject, still much of the work has been done by wholly

untrained and inexperienced men. Naturally as a result you have all seen the effects of much poor and unscientific work. Your local radiological colleagues with their earnest and scientific zeal in radiotherapy have convinced most of you of its value or I would not have been invited to present this subject before you.

In superficial lesions the problem is relatively simple. In deep lesions however it is much more difficult for one must always aim to preserve the normal tissues and the function of essential organs through which the radiation passes. Otherwise the problem would be merely a physical one to be solved chiefly by the physicist. In fact it has been the impression among many within recent years during which time one has heard much of the so called deep therapy that a physicist or a few hours instruction by a physicist was the most essential requirement.

A good radiotherapist must have a knowledge of general medicine (the more the better) and of general pathology and special pathology. He must be well informed in physics, electricity and mechanics and he must have an imagination that will enable him to picture in his mind the anatomy, the distribution of the disease and the distribution of the rays as each beam is directed into the body so that he can make the rays produce the greatest possible effect on the disease and the least upon normal tissue and organs. Therefore the greater the knowledge and skill of the radiologist the better will be the results.

## SUSCEPTIBILITY OF TUMORS

It has long been recognized that tumors vary to a considerable degree in their susceptibility to radiation. Even tumors of the same type vary considerably. Ewing says: "In general tumors derived from embryonal cells and retaining embryonal characters even when growing rapidly are as a rule particularly susceptible to radiation and in this

group some of the most remarkable and paradoxical of the radium cures have been recorded. Most of you and all of us radiologists have seen patients with most extensive disease—apparently hopeless cases—respond beautifully and go on to recovery while others with comparatively little disease show no response.

Iwing (2) classifies tumors according to their radio sensibility as follows:

- 1 Lymphoma lymphocytoma lymphosarcoma myeloma
- 2 Embryonal tumors carcinoma of the testes and ovary basal cell carcinoma  
Cellular anaplastic adult tumors  
round cell carcinoma diffuse carcinoma
- 4 Desmoplastic tumors carcinoma simplex fibrocarcinoma squamous carcinoma
- 5 Adenocarcinoma adenoma of the uterus intestine breast etc
- 6 Fibroblastic carcinoma osteosarcoma neurosarcoma

The *microscopical changes* in the cells under the influence of radiation consist of swelling hyperchromatism vacuolar degeneration and solution or fragmentation of nuclei hydropic swelling vacuolation and solution of the cytoplasm. Mitotic nuclei are particularly vulnerable the chromosomes splitting the spindle threads disintegrating and the whole cell undergoing relatively speedy solution. The surrounding stroma exhibits hyperæmia slight serous exudation outwandering of leucocytes and growth of new capillaries which in many instances probably plays a prominent part in the removal of tumor cells.

Radium is probably more selective in its action on tumor cells than the X rays. By his experiments on the larva of frogs Friedrich has found that the radiation from radium in like quantity has about three times the biological effect as compared with that from the roentgen rays. My clinical experience will confirm this observation. Therefore when one can choose it is advisable to use radium for the destruction of malignant disease whenever it can be brought in direct contact with the disease. The X rays however are preferable when the radiation must be carried to some depth through other tissues in order to reach the tumor or when

the disease must be destroyed at a depth of more than 3 centimeter (1) because the direction of the radiation from radium is most difficult to control while a beam of X rays can be directed almost like a bullet or a knife (2) because the radiation from radium like that of the X rays diminishes with the square of the distance which makes treatment with radium at a distance entirely impractical. The distance in the application of radium is measured in millimeters while most commonly the X rays are used at a distance of from 20 to 50 centimeters or even 100 centimeters. This is more than 100 times as great a distance which increases the relative depth value. Therefore we use radium in deep seated malignant disease only when it can be inserted into the diseased area such as in carcinoma of the uterus or when located in some of the cavities or when radium needles containing the radium emanation or radium element can be distributed evenly throughout the malignant tissue. We use the high voltage X rays when tumor cells must be destroyed at a depth of more than 2 or 3 centimeters and when crossfiring is an important factor.

Radium must no longer be looked upon as some magical substance which will work miraculous cures when applied to a patient suffering from malignant disease. Radium is an element which in its decomposition produces effects obeying physical laws which are as definite as the law of gravity or the laws governing the light from the sun. So too the X rays obey definite physical laws which must be understood and utilized properly.

#### LOW VOLTAGE RAYS VS HIGH VOLTAGE RAYS

The high voltage rays used in recent years have increased the penetrative value of the radiation about 25 to 30 per cent. Therefore as I stated several years ago one would expect about 25 to 30 per cent improvement in our therapeutic results in deep seated malignant disease and this is about what we are getting. Greater dangers are however involved and greater skill and caution are required. The agents are by no means a cure all. There will be more failures than successes. Most will depend

upon early recognition and early and skillful treatment of the disease either by these agents or operation

#### THERAPEUTIC RESULTS

The three great fields in which radiation therapy has been proved of definite value in the treatment of deep seated malignant disease are in carcinoma of the breast carcinoma of the uterus and in lymphatic tumors. While some brilliant results have occasionally been obtained in malignant disease of the viscera for the most part radiation therapy is as unsatisfactory as other methods of treatment of such cases. Therefore I think we will accomplish more in the brief space of time at our command if we discuss in more detail the above mentioned two or three groups.

#### CARCINOMA OF THE UTERUS

Most work has been done in malignant disease of the uterus. The results accomplished by the radiologists in the treatment of inoperable and hopeless cases of carcinoma of the uterus have gradually convinced the gynecologists of the value of radiation treatment and gradually one clinic after another has taken up the radiation treatment and applied it in the borderline and operable cases until now radiation is the method of choice in the treatment of all cases of carcinoma of the uterus except possibly in carcinoma of the fundus. Radiation is the method of choice in operable cases only however if the proper facilities are at hand and if sufficient skill and technical knowledge has been developed to give the treatment properly.

Many convincing tables of statistics have been prepared but the ones covering the widest range and the longest period of time I believe are those from the Doederlein Clinic in Munich (Table I) prepared by Seuffert (6).

The group of cases making up the operation statistics were treated during the years from 1908 to 1912 while those used for the radiation statistics were those treated from 1913 to 1916. This makes a fair comparison because all classes come into consideration and since the diagnosis and the classification

TABLE I—STATISTICS ON CARCINOMA OF THE UTERUS FROM THE DOEDERLEIN CLINIC MUNICH AS COMPILED BY SEUFFERT

GROUP I—Operable					
Therapy	Total Cases	Treated	Per Cent	Cured	Per Cent
Operation	26	110	42	5	46
Radiation	500	7	5	37	48
Completed treatment	77	43	55	35	8
GROUP II—Borderline					
Operation	65	57	2	3	5
Radiation	500	90	19	18	0
Completed treatment	60	50	56	18	36
GROUP III—Inoperable					
Operation	265	92	34	0	0
Radiation	500	24	43	13	6
Completed treatment	214	1	57	13	1
GROUP IV—Hopeless					
Operation	65	6		0	0
Radiation	500	110	23	1	0.8
Completed treatment	19	0	17	1	5

TABLE II—COMPARISON OF RESULTS OBTAINED BY OPERATION AND RADIATION DOEDERLEIN CLINIC AS COMPILED BY SEUFFERT

Cases Treated by Operation—1908 to 1912					
Cases	P	Cured	P	C	C
Group I	1	4	51	46	
Group II	57		3	5	
Group III	9	34	0	0	
Group IV	6		0	0	
Group I and II	67	63	54	32	
All groups	6		54	20	
Cases Treated by Radiation—1913 to 1916					
Cases	P	Cured	P	C	C
Group I	35	46			
Group II	5	5			
Group III	0	0			
Group IV	0	0			
All Groups	40	4	40	8	
Cases Treated by Radiation—1913 to 1916					
Cases	P	Cured	P	C	C
Group I	77	15	37	48	
Group II	90	0	18	0	
Group III	24	43	13	6	
Group IV	19	22	1	8	
Group I and II	93	55	5		
All groups	500		69	14	
Cases Completed Radiation Treatment					
Cases	Per Cent	Cured	P	C	C
Group I	43	55	35	80	
Group II	5	56	18	36	
Group III	11	57	23	1	
Group IV	0	7	1	0.8	
Group I and II	93	55	5	58	
All groups	234		67	29	

were all made in the same clinic from the same class of patients true comparison can be made

In order to make the relative values more clear, Seuffert has determined the absolute values in terms of cures (5 years) in terms of percentage of the total number treated by operation and those treated by radiation in values of the total number applying for treatment at the clinic as shown in Table II

These comparative tables show in the Group I of clearly operable cases 46 per cent cured by operation while 48 per cent were cured by radiation and of those cases which completed the radiation treatment 80 per cent were cured. The 80 per cent represented the value to the individual patient *who can complete the treatment*. In Group II which are the borderline cases operation cured 5 per cent while radiation cured 20 per cent or four times as many and of those which completed the treatment 36 per cent were cured. In Group III which were clearly inoperable operation gave no cures and radiation cured 6 per cent. Of those which were completely treated 11 per cent were cured as compared with no cures by operation. In Group IV which were considered absolutely hopeless none was cured by operation and one case or a little less than 1 per cent was cured by radiation.

In the study of Table II which shows the absolute value it is found that of the 265 operated upon during the years 1908 to 1912 54 cases or 20 per cent were cured but when the same curative values by operation are applied to the group of 500 patients who visited the clinic during 1913 to 1916 only 8 per cent could have been expected to be cured while of these same 500 14 per cent were actually cured by radiation or nearly twice as many. The superiority of the radiation as applied to all cases is therefore definitely established.

If one only considers those cases which completed the radiation treatment 29 per cent of all cases were found cured.

These statistics correspond very closely to those prepared by Heyman (4) from the cases treated in the Radium Home in Stockholm under the direction of Forssell. In the

operable and borderline cases he obtained 40 per cent cures after at least 5 years by radiation treatment. These results also correspond fairly well to those reported by Greenough as chairman of the committee on treatment of malignant diseases with radium and X ray appointed by the American College of Surgeons (3) in which 89 cases of carcinoma of the cervix proved by microscopic examination and treated by operation or radiation or cauterization or by combinations of these methods were reviewed and analyzed.

Of 829 women with cancer of the cervix 94 were free from disease 3 years or longer after treatment. More than half of these cures were obtained by the use of radium and the X ray without radical operation. No cures were obtained with the cautery alone. In 243 early favorable and borderline cases hysterectomy alone cured 1 in 3 with an operative mortality of 1 in 5. Radium with palliative operation (cautery) cured about 1 in 3 and radium alone (or with palliative operation) about 1 in 5.

In all instances I must urge that one must have a sufficient quantity of radium and must use in the neighborhood of from 5000 to 7500 milligram or millicurie hours of gamma radiation and sufficient high voltage rays to destroy the outlying cancer cells. One must have sufficient skill to distribute this radiation evenly throughout the diseased area and yet not overdose the essential organs in the pelvis.

The above discussion applies to cures. One must not lose sight however of the value of radiation as a palliative treatment in the inoperable groups where one obtains relief from pain hemorrhage and foul discharge. In fact in these advanced cases so long as the disease is confined to the pelvis one may obtain temporary complete relief of all symptoms and the patient may consider herself well.

#### CARCINOMA OF THE BREAST

The next great group of cases of deep seated malignant disease is carcinoma of the breast. In this group we have very few statistics. Statistics in carcinoma of the breast are most difficult to prepare because

very few early cases of carcinoma of the breast have been referred for treatment. Nearly all cases have been very advanced and hopelessly inoperable primary cases with recurrences or with metastasis. The other breast cases have been referred for pre-operative or postoperative treatment. I have written in detail upon these subjects and will discuss them only briefly here (5).

*Pre operative radiation* is indicated because as has been shown experimentally (1) it devitalizes the malignant cells so that they are not easily transplanted and (2) because tissue that has been irradiated does not easily take cancer when implanted and in fact it has a destructive effect upon cancer cells when implanted as shown at the Rockefeller Institute.

*Postoperative radiation* has been used over a longer period of time and some statistics are appearing as a result. The most convincing of these are those by Anschuetz (1).

The clinical material was obtained from the surgical department at the University of Kiel consisting of 230 cases of cancer of the breast operated upon by the same surgeon and verified histologically. All deaths occurring afterward were attributed to cancer though they may have been due to intercurrent disease. The cases were classified into three groups:

Group I Small movable cancers without palpable axillary lymph nodes

Group II Infiltrating cancers with adhesions and palpable axillary lymph nodes

Group III Large infiltrating cancers with axillary and supraclavicular lymph nodes

TABLE III—STATISTICS OF ANSCHUETZ AND HELLMAN ON CANCER OF BREAST

	Cases	Per Cent
Group I Series A		100
Group I Series B	6	100
Group II Series A	93	35
Group II Series B	96	5
Group III Series A	8	
Group III Series B	0	33

Series A 5 cases operated on before radiation  
Series B 1 case operated on after radiation

The value of postoperative irradiation is almost universally recognized. Almost every one has seen the remarkable disappearance

of recurrent carcinoma and since all recurrences develop from retained carcinoma cells it is logical to assume that the treatment which will make macroscopic lesions disappear should also make microscopical lesions disappear. Therefore the postoperative radiation should be applied as soon as practical after operation.

I think that in the future more primary cases will be treated by radiation. We have treated a number of primary cases in which the lymph nodes have disappeared and the infiltrating carcinoma has become freely movable. When this local mass is then removed and studied microscopically at times one finds no evidence of cancer. At other times a few cancer cells can be found embedded in the fibrous tissue. We have also had some excellent results in the treatment of primary cases with no operation.

The radiation treatment of distant metastases following operation is generally followed by retardation and at times disappearance of the lesion treated but practically always the patient develops other metastatic disease and ultimately dies of carcinoma.

The opinion is becoming pretty definitely fixed that more good is accomplished and less harm done in carcinoma of the breast by fractional dose treatment (relative) than by an attempt to deliver the full treatment in one day.

Time will not permit a detailed discussion of the treatment of other deep seated malignant disease. Most will be accomplished however in the individual case by a conference with the attending physician, the surgeon and the radiologist before any line of treatment is decided upon. At this conference the general condition of the patient, the extent of the disease and its nature should be determined and then the best means adopted for complete eradication of the disease.

#### CONCLUSIONS

The following conclusions may be drawn:

1. Patients should be taught to apply early for treatment. Any lump or abnormal bleeding may be due to cancer.

Physicians should learn to recognize cancer in its early stages.

3 Pre-operative irradiation will devitalize the cancer cell and prevent its transplantation or dissemination

4 Postoperative irradiation should destroy remaining carcinoma cells

5 Thorough and skillful treatment by radiation offers most in all stages of carcinoma of the cervix Sixty to 80 per cent may be expected to recover if treated in the earliest stages while less than 1 per cent will recover in the late stages

6 Radiation will not cure generally disseminated cancer The more extensive the disease the less the chance of recovery Radiation is a local method of treatment

7 Skill is required in deep radiotherapy in the same sense and degree that is required for successful surgery Surgical instruments are to the surgeon what radium and the X rays are to the radiologist

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## OSTEO-ARTHRITIC PROTRUSION OF THE ACETABULUM

By PHILIP LFWIN, M.D., F.A.C.S., CHICAGO

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**B**ECAUSE of the rarity of osteo arthritic protrusion of the acetabulum and of its almost complete absence from the American or English medical literature the subject seems worthy of a short discussion with the report of a case.

This condition was first described in 1844 by Otto of Berlin. In 1921 Valentin and Mueller gave it the name *intrapelne pfannen orsoelbung* or Otto-Chrobak pelvis. The only article in English that I have been able to find is that by Hertzler. He states that 34 cases were reported before his 4. The case herein reported brings the total to 39.

The cause of this condition is a combination of factors namely (1) hypertrophic arthritis of the hip joint (2) weakening of the acetabular floor (3) trauma due to weight bearing or injury and (4) muscular contraction forcing the head of the femur against the acetabular floor.

The hip is peculiar in that it is a large joint with comparatively small bones and powerful muscles surrounding it. Atmospheric pressure is great.

The pathology is that of (1) arthritis of the hypertrophic type and (2) protrusion of the femoral head through the acetabular floor.

The symptoms are those of a low grade chronic hypertrophic arthritis namely limp pain stiffness tenderness and limitation of motion in all directions but especially abduction and external rotation.

The roentgen ray findings are those of hypertrophic arthritis producing a cap like shell of bone surrounding the femoral head and the protrusion of the head through the acetabular floor projecting into the pelvis.

The direct diagnosis is made on the findings enumerated above. The differential diagnosis lies between an ordinary osteo arthritis and Charcot hip. The roentgenogram should determine the diagnosis.

The prognosis is bad as far as motion is concerned but good as regards relief from pain as ankylosis occurs.

*The course is long*

Treatment consists in search for and removal of foci of infection followed by orthopedic treatment. This includes (1) absolute rest in bed (2) application of Buck's extension and abduction weight and pulley traction (3) elevation of the foot of the bed about 8 inches (4) local anodyne applications to the affected hip region (5) application of a plaster of Paris spica cast or of an abduction hip brace (6) crutches and a inch block under the heel and sole of the shoe of the opposite side. The cast should be worn about 8 weeks and the hip then treated by diathermy and massage.

J. S. white male 64 year of age entered St. Luke's Hospital as a private patient January 14 1924 complaining of pain and stiffness in his left hip.

*Present complaint.* There was pain in the left hip joint in all position of the limb and rather acute pain at times but always a dull ache made worse by walking and not relieved by sitting.

*Onset and course.* Fifteen years ago he fell 12 feet down an elevator shaft landing on his feet. It was necessary for him to go to bed for a short time. Since then he states that the hip has bothered him gradually growing worse until now when he can scarcely walk because of pain. He is especially troubled after he has been sitting down for a time and attempt to rise. His hip is then very stiff and painful and after walking a short distance seems to lumber up some what. However he cannot walk very far without suffering fatigue of the left leg. The hip has never been swollen or tender. No other joints have ever been involved.

*History.* He has not been ill in any way for a number of years. He has had no tonsillitis or colitis but is subject to catarrhal disease of the nose.

No operations have been performed and there have been no injuries or accidents other than those mentioned. There was a possible specific urethritis 20 years ago but chance is denied.

*Interventions.* was negative except for nocturia 4 to 4 times depending upon the amount of water taken.

*Family history.* was unimportant.

*Illness.* The appetite was good sleep was restless because of the hip the bowels were normal.

The patient smoked 10 to 15 cigars daily until a year ago when he stopped. He did not use alcohol.





Fig. R. roentgenogram of hip showing the fracture of the femoral neck and the displacement of the femoral head.

**Physic Examination.** Patient is a well developed robust man of 64 not acutely ill with no irregularities or tenderness of scalp or skull. Hair is nearly bald. The pupils are equal and react to light and accommodation. They are both slightly flattened in the superior and nasal quadrant. The ears are normal. The eyes are normal and the vision is not impaired to gross tests. The hearing is not grossly impaired. There is no discharge, deformity or other abnormality of the ears. The nose shows no deformity, obstruction or discharge. The tongue is clean and protrudes in the middle without tremor. The teeth are all false. No root remains. In the throat are no signs of inflammation. The tonsillar crypts are clear. There is no stiffness or adenopathy of the neck. The trachea is well muscled broad and has normal excursions. The heart is not enlarged. There are no murmurs or thrill. The sounds are muffled but regular. The lungs show no malresonance. There is no abnormal voice or breath sounds or tactile fremitus. No rales are heard.

The abdomen is scaphoid and the muscles well developed. There are no tenderness, spasms, distention, etc. The liver and spleen are not palpable. The genitalia are normal with no scars or discharge.

The right leg and hip are normal in all respects. The knee jerks are equal and active. There is no Babinski or ankle clonus. There is limitation of motion and muscle spasm about the left hip joint.

but no notable swelling, heat or redness. The joint cannot be flexed past a right angle and cannot be hyperextended. Abduction and rotation are limited.

**Progress notes.** January 15, 1924. The patient entered the hospital yesterday complaining of pain in the left hip. Anodyne lotion and hot fomentations were ordered and traction applied. Foot of bed was elevated 8 inches.

**Roentgen findings.** Left hip. The acetabulum is greatly thickened, the condition having the appearance of an osteosclerosis. The articular surface of the acetabulum seems eburnated. The head of the left femur is thickened and I believe is displaced inward. There is, however, no evidence of a fracture involving the proximal third of the left femur. The increased density involving the acetabulum may be due to old injury accompanied by an infection which is in a stage of repair.

January 17. There is no complaint. There has been no further pain in the hip. Cast will be applied in a few days.

January 21. There has been no pain in the joint since treatment was begun. Crutches are ordered.

January 23. Traction is removed and spica cast applied.

January 2. There is no pain in the hip. Patient is discharged in good condition, using crutches and a 2 inch block under right heel and sole. He is to wear the cast about 8 weeks and follow its removal with diathermy and massage.

**RE—**The roentgenogram and roentgen findings reported this letter were taken by Dr. E. L. Johnson.

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DELTOID PARALYSIS FOLLOWING SHOULDER INJURIES<sup>1</sup>

By JOSEPH I. SMITH M.D. F.A.C.S. AND H. H. CHRISTENSEN M.D. WISCONSIN

FOR many years works on anatomy and surgery have contained frequent references to paralysis of the deltoid muscle as a consequence of various types of injuries to the shoulder. In spite of the fact that these observations have been repeatedly recorded we have searched in vain for any adequate or definite description of the mechanism involved in the production of the injuries or of their exact pathological anatomy. In this connection the following two cases which have recently come under our observation have been of unusual interest to us and we have thought that a brief report might be the means of eliciting discussion which would throw some light on the obscure mechanism and pathological anatomy of these lesions.

CASE 1 H. A. Finlander laborer age 36. On November 1, 1923 while cutting timber for a lumber company he was struck on the head and left shoulder by the limb of a falling tree. He was knocked down and remained unconscious. He thinks for a few minutes. He was cared for by a nearby physician and sent to a hospital in a neighboring town where he remained in bed 2 weeks. He does not know what was done to him by the physician who rendered first aid. He came into our hands on December 3, 1923 at which time he was unable to raise the left arm to a horizontal position. The left deltoid was markedly atrophied and showed the reaction of degeneration. The area of anesthesia extended over the deltoid area with slightly impaired anesthesia over a somewhat larger area. This patient showed complete paralysis of the triceps muscle and there was some atrophy of the spinati. The other muscles of the shoulder and arm were intact. The patient was put upon electrical stimulation massage and passive motions which he continued until March 18, 1924, at which time a no definite improvement had taken place. It was decided to carry out an operation with a view to locating the site of the injury and of repairing the if possible.

On account of the possibility of paralysis of the spinati and the definite paralysis of the triceps we first cut down upon the primary lesions of the plexus in the neck and then proceeded to demonstrate definitely that the first section of the primary division was intact and free. An incision was then made along the anterior border of the axilla after the method of Stiles. The pectoralis major cut at its insertion the neurovascular bundle exposed and followed from below upward.

The circumflex nerve was found by following upward the musculospiral nerve to the origin of the circumflex as it springs from the musculospiral and enters the quadrilateral space just above the latissimus dorsi tendon. On freeing the nerve at a distance of about an inch from its origin we came upon a definite bulb-shaped neuroma beyond which the continuity of the nerve was severed. The neuroma was resected and what was thought to be the peripheral fibers of the nerve were freshened and brought up and sutured to the proximal segment. The cut muscles were sutured and the wound closed. The patient was seen 9 months after the operation at which time he showed little if any signs of nerve regeneration.

Just what happened to this man at the time of the injury we could not ascertain. It is possible he may have had a dislocation which was reduced by the physician who rendered first aid. The point of interest in this case is the finding of a definite solution of continuity in the circumflex nerve with the development of a typical bulbous neuroma at the site of section.

CASE 2 H. Y. laborer aged 48 injured April 11, 1924 when he was struck on the left side of the head and on the left shoulder by a falling limb. He was knocked down and dazed but not rendered unconscious.

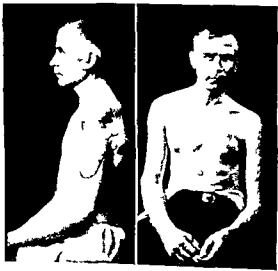


Fig. 1 (left) Case 1, before anesthesia. Fig. 2 (right) Case 1, after exposure, showing circumflex nerve. Case 1, before regular exercise, May 6, 1925.

<sup>1</sup> Read before the Chicago Surgical Society.



1922 the large majority of which had moderate or severe diabetes there were twenty known deaths and four probable deaths the latter leaving the hospital in a severe condition refusing all treatment. Omitting these four cases the mortality of this series was 42.5 per cent.

Since the advent of insulin fewer figures are available. Allen and Sherrill (3) found that among 14 cases complicated by local or general infection there were five deaths. Weedon (66) reports a mortality of 16.6 per cent in a series of 12 cases three of which as judged from their clinical course owe their lives to insulin treatment. Joslin found a 9 per cent mortality in a series of 61 cases omitting carbuncles and gangrene. Since 1923 22 cases of diabetes mellitus associated with some surgical condition have been treated on the Second Surgical Division at Bellevue all but two of which received insulin and with but one death (4.5 per cent). Of this number five would have had very little hope without insulin. The one death was in an extensive carbuncle of the neck although the diabetes responded to insulin.

Carbuncles have long been associated with diabetes as a result according to Higginson (34) of the sapraemic poisoning from the carbuncle lowering the saturation point for the body with hyperglycemia or glycosuria resulting. Because of the difficulties in treatment the mortality is high. Karewski (39) reports a 33 per cent mortality in 37 cases. In 42 carbuncle cases reported by Muller (48) 6 (14.3 per cent) were diabetic of which 4 (66.7 per cent) died while only one (2.8 per cent) death occurred in the non diabetic group. Since 1916 there have been 123 cases classed as carbuncles treated on the Cornell Service of Bellevue 13 (10.5 per cent) of which occurred in diabetics. Of the 13 diabetics there were 7 deaths (53.8 per cent) while there were only 7 (6.3 per cent) deaths in the 110 non diabetics. As Muller has pointed out this is sufficient evidence to disprove the older opinion as expressed by Smith and Durham (56) that the presence of glycosuria does not have a tendency to influence the course of the carbuncle in any way for the worse.

#### ANÆSTHESIA

The question of anæsthesia in operations on diabetics is a moot point and has received a great deal of discussion. Nearly every possible anæsthesia has at some time been advocated by someone and advised against by others. Local anæsthesia is nearly universally advocated either alone (Bruce 10 Plicque 5 Labbe 45 Umber 63) or with nitrous oxide if necessary (Murphy 49 Tytgat 62 Leyton 46 Kahn 38) or with ether (Jones McKittrick and Sisco 35 Adams and Wilder 1). Muller (48) feels it is contra indicated since it predisposes to extensive necrosis if infection occurs. Procain novocain and cocaine are most commonly used. Nitrous oxide probably has more advocates than any other form on the principle that the patient recovers more quickly and the alkaline reserve is less affected (Berkman 6 Costain 15 Fitz 5 Murphy 49 Leyton 46 Cheever 14 Cruikshank 16 Jones 36 Kahn 38 Young 67 Muller 48). The use of ether instead of nitrous oxide is advocated by a few (Jones et al 35 Adams and Wilder 1). Ether is strongly advised against by Labbe (45) Jones (36) and Muller (48) and Harrop (32) states that it should be avoided since it has recently been shown that it probably has a specific destructive action on insulin. Spinal anæsthesia is advocated by Labbe (45) Leyton (46) Umber (63) and Muller (48). Ethyl chloride has been successful with Labbe (45) and Plicque (5). Chloroform has been used by Chavannez (13) unsuccessfully and is generally considered the poorest anæsthetic (Murphy 49 Plicque 52 Labbe 45 Cruikshank 16 Jones 36 Blum 8 Farr 23).

An interesting sidelight on the question is thrown by Dewes (10) and also Chantraine (12). Dewes found that in laparotomies there was an increase in the blood sugar with either local anæsthesia or ether to two to four times the normal figure and with no difference between the two forms of anæsthesia.

On the Second Surgical Division the anæsthetic varies with the case. Spinal anæsthesia has been used successfully in leg amputations. For short minor operations (carbuncle abscess cellulitis) gas oxygen with local anæsthesia has been very satisfac-

tory as also has been ethyl chloride. In one case of multiple abscesses ethyl chloride was administered five times and has proved probably the most satisfactory for short operations. For more prolonged operations (cholecystectomy mastectomy) we use gas oxygen changing to gas oxygen ether mixture after induction has been well started.

#### TREATMENT

The treatment may be divided into preoperative and postoperative but every case of diabetes in surgery requires treatment somewhat different from any other case and while specific methods as used on this service cannot be outlined in detail an attempt will be made to list the general steps. The basic principles on which the treatment is given are (1) to provide a maintenance diet and (2) to control the diabetes with insulin as early as possible maintaining the blood sugar at about the renal threshold controlling the dosage by frequent urinalysis and where necessary blood sugar tests. We feel that there is a marked contrast between the way uncomplicated diabetes and diabetes complicated with surgical interference should be treated. Time is of tremendous importance in surgery in even moderate diabetics and generally cannot be spent except with much increased danger to the patient in waiting several hours or longer for a blood sugar test. Surgical diabetes *must* be treated intensively at the earliest possible moment until the surgical condition is remedied a point which we feel is not always fully appreciated by the internist.

Whether it is before or after operation with the patient in coma or with mild diabetes the immediate problem is the same namely to gain control of the diabetes. In severe cases requiring operation where marked acidosis is present if an interval of 12 hours or more can be spared during which intensive treatment can be given the chances for recovery from the surgical condition are much improved.

There are certain general steps followed out in every case of diabetes

1 *Urinalysis* including specific gravity amount qualitative sugar acetone and diacetic acid is the first step in every case

and is performed immediately on admission. The urinalysis is repeated every 3 hours as long as the patient shows sugar. Bingham (9) advises urinalysis of all specimens but we have found it necessary to catheterize in some cases rather than wait for voluntary voiding. Benedict's solution is used for testing sugar and the result determines the subsequent insulin dosage as given below. We do not do quantitative examinations on each specimen (although this was tried for a period) since the additional information gained is negligible. As long as the patient continues to show sugar 24 hour specimens are not saved but each specimen is examined immediately. Jones McKittrick and Sisco (35) follow the plan of frequent urinalysis but it is performed by the nurse who also administers the insulin dosage according to her findings. On the Cornell service the urinalysis and insulin dosage is always in charge of the surgeon and it has been found more satisfactory to have one man assigned to all the diabetic cases on the service.

Of the various tests the sugar test is the most important. Using Benedict's solution one can roughly estimate the amount of sugar present by the degree of precipitation of the copper oxide. Diacetic acid is of more significance if present than acetone and is less likely to be present on a starvation diet than acetone. However we differ from Manges (47) who states. There is no danger no matter how intense the acetone reaction may be when the diacetic or oxybutyric acid tests are negative. Several of our cases have had a low carbon dioxide content of the blood with 4+ acetone and negative diacetic acid test of the urine. Hence consideration is given to the acetone reaction and following the clearing of the glycosuria close attention is paid to clearing the ketosis. In one case (cholecystectomy) there was only a slight amount of sugar after operation but a marked ketosis which cleared with insulin therapy. Thalhimer (61) Fisher and Snell (24) and Speese (57) have advocated the use of insulin in non diabetic acidosis.

2 *Insulin administration* follows the urinalysis. Our aim has been to reduce the glycosuria as soon as possible. This is done

by analysis every 3 hours with immediate insulin administration based on the findings at each examination. This 3 hour repetition is continued until the glycosuria is reduced to a trace. As long as the patient has an acute surgical condition we have found it the better of two evils to reduce the glycosuria to a trace maintaining it about the renal threshold and so prevent a hypoglycæmia. This is against the advice of Allen and Sherrill (3) and Joslin (37) although the latter was not speaking specifically of surgical conditions but we are supported by Foster (26) Brining Campbell and Fletcher (5) Jones et al (35) Foster has termed it the "buffer sugar".

The quantity of insulin to be given in each dose must be determined by the urine findings (or blood findings) and is largely a matter of experience. On this service when the Benedict's solution is turned a golden yellow red 20 to 25 units are given. The amount lessened as the solution becomes green. The amount which may be given in any definite length of time certainly has a limit but as long as glycosuria is present there is no danger from hypoglycæmia. In one case 140 units were given in 14 hours and in a second 125 in 24 hours with satisfactory results.

In cases where acidosis is present without glycosuria or where the glycosuria has cleared it is necessary to administer glucose with the insulin. At least 50 to 100 grams of carbohydrate should be given a day until the acidosis has cleared. Orange juice by mouth is sufficient or if the patient cannot take fluid by mouth 5 per cent glucose is given by rectum. If this cannot be retained 10 per cent or even 20 per cent glucose solution can be given intravenously. In such cases it has been found advantageous to disregard any glycosuria that may appear until the acidosis is cleared.

One other point has been observed regarding the dosage of insulin which has previously been noted by others. The insulin tolerance in cases of infection is much reduced as the infection subsides. Not infrequently its administration may eventually be entirely unnecessary. Hence while the initial 4 hour quantity and often that for the second and third day may be large it must gradually be

reduced. When the glycosuria has cleared and insulin is necessary to maintain the patient's status *pro tempore* it is given three times a day. We have found Allen's (4) suggestion successful in giving the morning dose about an hour before breakfast the noon dose a half hour before or just at meal time and the evening dose from one half to an hour after upper omitting any night dose.

**Fluid intake.** Before operation the patient is given considerable water on the principle that it is more advisable to give the patient considerable water before operation than to find it necessary to force it after operation. As Joslin (37) and Kahn (38) have suggested no set amount is given but the patient is supplied freely by mouth and if necessary by rectum or subcutaneously. Following operation the patient receives at least 2000 cubic centimeters during the first 4 hours by mouth if possible or if not four to six ounces of tap water every 6 hours by rectum and the rest by saline hypodermoclysis. A 3 per cent glucose saline dlysis has been used satisfactorily in indicated cases.

**Diet.** We believe that the particular type of diet makes little difference so long as it is closely watched. As Foster (26) has suggested and as is used on the Second Medical (Cornell) Division of Bellevue the patient is started with a quart of whole milk per day. This places the patient immediately on a known food intake which is continued until a special diet can be obtained. The diet consists of 1 gram of protein per kilogram of body weight the remainder of the caloric requirement of carbohydrate and fat in a 1 to 3 ratio allowing 30 calories per kilo of body weight. Petty (50) also uses this diet. The caloric intake is increased to 35 calories per kilo when the patient is allowed out of bed and to 40 when up and around the ward depending somewhat on the diabetic condition at the time.

The question of under nutrition is undecided. Allen and Sherrill (3) favor moderate under nutrition. Joslin (37) suggests a preoperative dose of 15 to 20 calories per kilogram. Jones et al (35) give 20 calories per kilogram. Delbet (18) feels that carbohydrate need not be decreased. Muller (48) brings the

patient only to the carbohydrate tolerance Banting Campbell and Fletcher (5) increase the carbohydrate above the patient's tolerance and give insulin to prevent glycosuria.

Postoperative specific measures used vary considerably with the operation. The maintenance diet mentioned above is reached as soon as possible. In severe cases only carbohydrate is given the first day at least 100 grams in 24 hour in the form of 3 per cent hypodermoclysis 5 per cent glucose by rectum or by mouth as orange juice if possible. Such is repeated until danger from acidosis is past. Milk and eggs are added by the third or fourth day even in major operations followed by a portion of the regular dietary ration and increasing to the full diet in 6 to 8 days.

**5 Blood chemistry.** While blood chemistry is interesting and may be helpful in cases other than coma or partial urinary retention as long as glycosuria is present it is not essential. It is often impossible and generally impracticable to obtain blood sugar determinations every 3 hours during the active glycosuria reduction. Some workers (19, 36) feel that insulin cannot be given intelligently without knowing the blood sugar with which we disagree provided the above conditions are present. As has been mentioned small amounts of glucose in the urine may even be desirable to aid in the administration of insulin during the acute stage of the surgical condition.

However in coma or with partial urinary retention and when the glycosuria disappears blood sugar determinations must be carried out to administer insulin intelligently. Also in the presence of nephritis or in other cases where the threshold is very high blood sugar determinations are very desirable. One case in this series showed a renal threshold for glucose between 240 and 60 milligrams per 100 cubic centimeters. We do believe that as soon as safely possible the blood sugar should be reduced to and maintained within normal limits.

**6 Alkali and drug therapy.** For many years alkali has been one of the important therapeutic agents used in diabetes. In the presence of surgical complications it has been advocated by many (Berkman 6 Bruce 10

Koerte 41 Schwartz 54 Plucque 52 Labbe 45 Umber 63 Addis 2 Reisman 53 Krecke 43 Muller 48) but usually in widely varying doses in various methods and at times for administration. Among medical men von Noorden and Woodjatt Allen Bock and Fitz (65) have advocated it but they also vary in their dosage. Foster (27) has found the result often disappointing. Joslin (37) does not use them and found his case got along just as well or better. In the present series it was used in the earlier cases but without observed beneficial effect. It has not been used in the more recent cases.

Other drugs have been used for symptomatic treatment. Cumston (17) suggests strychnine as a tonic to the gastro intestinal system, glycenn to counteract weight loss and opium to check thirst. Murphy (49) also mentions opium as a valuable adjunct.

**7 The reduction of the toxæmia** is important in every surgical diabetic. Infection plus the fever gives an increased metabolism. The toxæmia from the infection gives anorexia plus nausea and vomiting and hence energy must be derived from the body tissues chiefly from the surplus body fat. The glycogen reserve is at once exhausted and the only carbohydrate comes from the protein and is inadequate for the combustion of the fat. The patient promptly develops a severe acidosis and tends toward an acidosis state as soon as he is infected for he then burns more carbohydrate than before. The reduction of the toxæmia in many cases depends on immediate and adequate drainage. Insulin while of tremendous aid cannot overcome a severe infection (Strouse and Schultz 60).

#### TRAUMATIC GLYCOSURIA

The frequency of traumatic glycosuria has been mentioned but rarely does it prove a serious problem for the surgeon. Kausch (40) in an excellent review of cases up to 1914 is skeptical as to any relation between trauma as a cause and diabetes. Joslin has pointed out that the World War did not increase diabetes. Of the 212 cases studied by Higgins and Ogden (33) only three showed any lasting glycosuria. One case studied by Konjetzny and Weiland (42) showed a blood sugar of 357

milligrams per 100 cubic centimeters. A case reported by Ginsberg (30) developed a blood sugar of 35 milligrams per 100 cubic centimeters following trauma with acetone and diacetic acid in the urine which responded well to insulin and entirely cleared in 20 hours. A similar case was admitted to the Second Surgical Division last fall.

M. S. a male of 35 with an entirely negative history for diabetes was admitted about 3 p.m. having fallen from a scaffolding striking his jaw and arm. He appeared in good condition complaining only of pain where struck. X-ray examination revealed no fracture. About 6 hours later the patient became restless, anxious and appeared as in shock suggestive of an internal hemorrhage. Stimulative measures were given without changing his condition. His urine examined at 11 p.m. showed a heavy precipitate of glucose (Benedict) acetone 2 plus and diacetic acid. He was given intensive treatment with insulin receiving 95 units (U20 Lilly) in 24 hours. Clinically he responded rapidly, the urine became entirely negative. He was placed on a maintenance diet of 1830 calories without insulin. Two days later his blood sugar was 120 milligrams and carbon dioxide 50 volumes per cent. He left the hospital on the sixth day feeling well was on a regular diet and showed no symptoms or signs of diabetes.

Although this division has a very active traumatic service this is the only case of traumatic glycosuria receiving insulin. We feel that this case represents a true diabetes though temporary in the sense that glucose is improperly burned or that excessive glycogen is discharged from the liver with hyperglycemia and acetone body formation probably due to a temporary disturbance in the nervous mechanism controlling carbohydrate metabolism. Its treatment is essentially the same as that of a severe diabetic.

#### SUMMARY

1. In a series of 47 cases treated before insulin there were 6 deaths (42.5 per cent) and four additional cases which left the hospital in a critical condition refusing treatment. In a series of 22 cases treated with insulin there was one death (4.5 per cent).

2. Urinalysis is performed every 3 hours as long as the patient shows glycosuria with insulin administration based on the findings.

3. Fluid intake is encouraged preoperatively and forced to at least 1000 cubic centimeters daily postoperatively.

4. The diet given allows 30 calories per kilo body weight with one gram of protein per kilogram of body weight and the remainder in carbohydrate and fat in the ratio of 1 to 3.

5. Blood chemistry is very desirable in cases of complete partial urinary retention and after glycosuria has disappeared. In the great majority of cases it is not essential while the patient shows glycosuria and very valuable time is lost with much increased danger to the life of the patient in waiting several hours for a blood sugar determination.

6. Alkaline therapy is not used at present.

7. Traumatic glycosuria may be effectively treated when necessary with insulin.

I shall express to Dr. H. I. Santee, director of the Second Surgical Division, my appreciation of his courtesy in giving me the opportunity to report on the above cases.

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## BENIGN TUMORS OF THE STOMACH

By E. L. ELIASON, M.D., F.A.C.S. AND A. W. MURRAY WRIGHT, M.D., PHILADELPHIA

**B**y benign tumors of the stomach is meant adenomata, papillomata, myomata, fibromata, cysts, angiomas, lipomata, osteomata, myxomata and the misnomer polyp. Under the head diverticula, lymph node enlargements, hypertrophies, abscesses, aneurysms and indurated swellings are not included.

Benign tumors of the stomach have been looked upon as rare conditions. In comparison to their malignant fellows they are quite occasional, but an exhaustive survey shows that the reported cases are well on their way to the thousand mark.

Like any condition that is new or unusual, the subject of benign gastric tumors is one that has been attended with considerable confusion as regard diagnosis, classification, etc. It is the purpose of this article to bring before the profession at large a condensation of reported and collected cases together with a personal collection so that an opportunity is afforded for comparing cases, abstracting diagnostic features and noting outstanding features in various types and so that a reference list is provided giving the special features. It is our hope that our readers will note that the condition is not so infrequent as it seems and that they will be able to give more thought to the unusual and undiagnosed cases that they will make further use of the X-ray in gastric cases and operate (early) upon gastric cases that are benign or doubtful, thus saving lives that would otherwise be lost.

## ETIOLOGY

The etiology of the benign tumors of the stomach as a whole does not appear to be any different from that of the same tumors elsewhere in the body. No new features in connection with the following cases have been found. Among the causes given by various authorities are chronic gastritis, alcoholism, dietetic errors, improper mastication and atheroma of blood vessels. It is doubtful if any one of these causes is the specific agent any

more than it would be for the same type of tumor elsewhere. Attention is called to the fact that in the majority of the personal cases of pedunculated polyps (many of which are myomata, adenomata and fibromata) chronic gastritis microscopically was proved a concomitant feature, that the hypertrophic form predominated and that 80 to 90 per cent of the cases occurred among the laboring class. For the pedunculated types of tumor especially those located in the pyloric end, it is the authors' belief that a low grade inflammation of the mucosa occurs as a result of chronic irritation (either physical, nutritional, functional, chemical or bacterial) causing a local hypertrophy (see Case 39). Once the hypertrophy forms, it is increased mechanically by contractions of the stomach peristaltic waves and the pressure of the gastric contents as they are forced by on their way to the pylorus. This results in their being pushed along or lengthened out in the general direction of the pylorus. As the tissue continues to grow, it does so at the expense of the stalk or pedicle which is stretched by the engulfing food being forced past and around it. Later when it is sufficiently large and long enough to do so, it is swept or carried into the pylorus by a peristaltic wave and produces the typical ball valve syndrome attack of pain.

A case recently operated upon by the senior author illustrates this pulled condition of the gastric mucosa. The patient was a male aged 56 with a clinical and X-ray diagnosis of benign tumor of the stomach prolapsing through the pylorus. At operation a doughy mass was felt projecting through a dilated pylorus into the duodenum. During palpation this mass slipped back into the stomach and could not again be pushed through into the duodenum. Gastrotomy disclosed the fact that the gastric mucosa around the entire circumference of the prepyloric area was very freely movable on the muscle coat and could be pushed along by the finger through the pylorus causing an intussusception of a complete gastric mucous membrane cuff.

Basch notes that all polypoid cases are accompanied by chronic gastritis. Hauser and

others cited by Bryan believe gastric polypoid is to be due to chronic inflammation. Konjetzny has demonstrated the progression of gastritis to adenoma and thence on to adenocarcinoma. Otto cited by Bryan reported in adenoma in which was found a splinter of wood that had been swallowed. Zabel according to Bryan found large numbers of megastoma intestinalis in the tufts of a large gastric papilloma with malignant degeneration. It is not at all impossible that low grade bacterial infection of the gastric mucosa due to a previous weakening or nutritional disturbance of the mucosa may cause in early stages some of the hypertrophic condition which later develop into any of the various tumors.

#### SYMPTOMATOLOGY

*Physical.* In the majority of cases there is no pathognomonic sign. There are however a few syndromes which occur with certain type viz (1) gastric polypoid (2) angiomata (3) large myomata (4) ball valve tumors. As the size varies in the different types from a split pea to that of a man's head it will be readily seen that an entire absence of symptoms can occur and it may be possible definitely to palpate the tumor itself. The vast majority are less than a hen egg in size. Many are internal that is within the gastric cavity some are intramural and a few are external or free in the abdominal cavity. Unless large pedunculated and external they are not discoverable by physical examination. They are sometimes associated with gastric ulcers and carcinoma and any symptoms which they cause are lost in those of the associated condition.

The syndromes referred to above in the four mentioned types are:

1. *Polypoid.* In the presence of polypoid we have indefinite gastric disturbances over a long period of time gradually growing more and more severe with loss of weight incommensurate with their appearance and symptoms which are neither typical of gastric ulcer carcinoma or the usual gastric disturbances. A fairly typical picture is indefinite pains becoming marked for 2 to 3 months before patient consults a physician with no reference to meals position etc. except that

the pain is relieved by frequent amounts of food taken in small quantities. At this stage the patients begin to lose weight rapidly and they become very weak and anæmic with or without hæmatemesis or melæna and they present pictures that remind one of ulcer or malignancy but the course is too rapid.

*Angiomata.* Depending upon the size a variety of symptoms occur in the presence of angiomata. The symptoms vary from those of an acute gastritis to hæmorrhagic ulceration hæmatemesis and melæna with spasmodic rapid loss of weight accompanying them pain then a temporary recovery followed by a repetition of these symptoms a marked anæmia loss of weight and occasionally an intermittent febrile condition. Ulceration no doubt is the cause of hæmorrhage when it occurs. If the growth is small it may give no definite symptoms at all.

3. *Large myomata.* These growths may or may not have a pedicle. Because of their size they are sometimes palpable. The patient describes them as heavy lumps which change position and at times disappear—phantom tumors or external pedunculated myomata. When large internal myomata may occlude or partially obstruct the passage of food and cause spasmodic contraction pains.

4. *Ball valve tumors.* The ball valve syndrome is typical only of pedunculated internal tumors of the stomach situated near the pylorus or in the pyloric half and is characterized by repeated paroxysmal paroxysmal attacks of gastric pain accompanied by temporary prostration anorexia anæmia hæmatemesis or melæna and rapid loss of weight. This is due to the temporary enveloping of the tumor and its pedicle by the pylorus. Later when it is freed the patient's symptoms subside he rapidly improves and continues in good health until another attack occurs caused by the ball valve action of the pedunculated tumor closing the pylorus. If relief does not take place or operation is not performed intussusception of the pylorus and pyloric end of the stomach into the duodenum occurs with fatal results.

#### LABORATORY

Gastric analysis shows nothing typical. Achylia hypochlorhydria normal acidity and

hyperacidity occur. Cases are reported with achylia and hyperacidity previous to operation which persisted after the removal of the tumors. The so called egg white like mucus noted by Bryan and others was observed only once in the personal series of 50 reported. In rare cases where a gastric lavage has been performed small pieces of tissue from the tumor have been recovered which when examined microscopically proved to be the same as that of the tumor subsequently removed at operation. Pieces of tissue from tumor fragments found in the stool may have become detached from intestinal tumors as pointed out by Struthers in his series of gastro intestinal benign tumors. Hematemesis, melena, low hemoglobin and low red blood cell content occur in those cases in which ulcerations accompany the lesion or in which incarceration by invagination of the tumor occurs as well as in cases with angoma.

#### ROENTGENOLOGY

By far the best diagnostic means at hand today in the diagnosis of benign tumors of the stomach is the study of that organ by the X ray. Though the picture is not commonly met with in X ray work, as some statistics would indicate a scrutiny of the literature shows at least 50 cases that have come to X ray. Once seen it presents a picture which impresses one greatly as being so different from the picture of any other condition that it may cause surprise and doubt when first observed. The photographic copies by Gassman, Ballour, Basch, Eusterman and Senty, Moore (a very good myoma), Matas and a very clear ulcerating fibroma by Stetten are commended to the reader. Others who have noted the condition by X ray and who give good descriptions are Brin and Denecheau, Schlesinger, Heinz, H. Heinz, Konjetzny, Lederhose, McCullough, Neuber, Payr, Poth, Dessecker, Myer, Stoner, Carman, Hahnes, Ruggles, Merrill, Paus, Geymueller and Lieblein.

The single tumors which are large enough to be discernible stand out as globular, smooth, regular, clear and persistent shadows either on the lesser or greater curvature and by their very smooth uniform outline immediate

ly strike one as not characteristic of the irregularity of malignancy and the scooped or punched out areas of ulceration. Occasionally as in the case of Neuber, Gassman, Brin and Denecheau, Basch, Eusterman and Senty, the pedicle itself is discerned as the barium trickles by it. It should also be noted that pedunculated tumors attached to the anterior or posterior walls have been overlooked at one X ray examination to be found at a subsequent one when the patient was photographed in the prone position or was manipulated under the fluoroscope. The prone position best brings the tumor out in cases in which the tumor is not otherwise in apposition with the walls.

Hemangiomas and cysts give a clear picture unlike the appearance of any other tumor and are quite typical. Moore gives the best pictures and reproductions.

Gastric polyposis gives a distinct mottled appearance not dissimilar to a bunch of grapes and is most frequently seen in the pyloric end. It reminds one of a sponge with its many punched out mottlings.

Diagnosis by the position the tumor occupies in the stomach cannot as yet be made with certainty according to types though the attached table will show to the reader the commonest situations.

Schlesinger says benign tumors can only be diagnosed as such when the contour shows smooth round lines. Neuber points out a bilocular appearance in pedunculated myomas. Carman has seen very few cases (7) in 50,000 X ray examinations of the stomach and considers the condition as relatively rare. Moore reviews 23 X rayed cases and states

it seems that benign gastric tumors manifest certain signs roentgenologically which differ from those found in malignant or inflammatory lesions. If these signs are not characteristic they are at least suggestive.

1. They produce a filling defect that is circumscribed and punched out in appearance.

2. The filling defect is usually on the gastric walls leaving the curvature regular and pliant.

3. While the rugæ are obliterated in the immediate area of the tumor just as in inflammatory and malignant lesions, the rugæ

surrounding a benign tumor are more clearly normal in their arrangement and distribution.

4 They cause little or no disturbance of peristalsis and retention is uncommon except when the lesion is at or very near the pylorus.

5 They do not reveal a niche nor is there an incisura or other evidence of spasm.

6 They are rarely sufficiently large to be palpated.

Probably the most essential feature in the examination is the close and complete approximation of the walls of the barium filled stomach. This can be accomplished only by deep and thorough palpation and manipulation thorough relaxation of the abdominal muscles is of course necessary. The patient should be rotated in both lateral directions and the stomach carefully scrutinized in the horizontal and vertical position. The solution of barium should be closely observed as it enters the cardia and passes over the posterior wall for occasionally a tumor projecting from the posterior wall will cause a splitting of the column thereby giving the first appearance of its presence. A very small benign tumor is difficult and sometimes impossible to visualize however even a very small tumor near the pylorus will usually produce a definite filling defect.

Differentiation roentgenologically of benign tumors and other gastric lesions can seldom be absolute but in many instances the roentgenological signs warrant an attempt at such a distinction.

Certain findings are strongly suggestive of their presence and when such signs are noted the roentgenologist should hesitate to report the lesion as malignant and inoperable especially if the clinical manifestations are indeterminate.

#### PATHOLOGY AND TYPES

This description is a composite one of tumors collected to date and is quite general. The main features only are given as the detailed minutiae vary so greatly.

*Myomata.* This type seems by far to outnumber all the others averaging in our collected series nearly 60 per cent this without including a number of the Deaver and Ashurst collection. Fibromyoma fibroleiomy-

oma adenomyoma leiomyoma myoma and adenoleiomyoma are included under this heading.

As a whole the myomata are hard smooth round or lobulated and circumscribed tumor sessile or pedicled and lying free in the stomach in the gastric wall or attached to the serous surface. The great majority of them seem to be serous or subserous. Their size ranges from that of a pea to a mass weighing 6000 grams and unlike some of the other type which seem to have a predilection for the pyloric end affect chiefly the anterior and posterior wall lesser and greater curvatures.

The age at which they are most often found averages between 40 and 50 two cases as young as 20 and as old as 83 are reported. Females are more often affected than males.

They may be single or multiple but incline to the former. Ulceration degeneration and malignant changes have been noted. Paterson notes that in 14 recorded cases secondary deposits leiomyoma malignum were found while Basch (in Tice) has observed that histologically they are made up of undifferentiated muscle fibers mixed with strands of fibrous tissue that the submucous types are apt to undergo cystic degeneration whereas the subserous or serous type are more prone to develop sarcomatous changes.

The review of a large number (310) of cases causes one to formulate the opinion that they are far from being as benign in their end results as their benign classification suggests.

*Papilloma.* Under this heading are included the papilloma adenopapilloma and the condition spoken of as papillomatosis. The latter term is reserved for cases which show a rather profuse collection or scattering of papillomata throughout the stomach and should not be applied to gastric cases which simply show a few multiple papillomata. Histologically Delafield and Pruden observe. In some cases of chronic gastritis there are small polypoid hypertrophies (polypi) of the mucous membrane. Besides these we find polypoid tumors which may reach considerable size. They are composed of a connective tissue stroma arranged in tufts covered with cylindrical epithelium so that the tumor has partly the structure of an adenoma (papillary adenoma).

Papilloma of the stomach is frequently classified by surgeons under the term polyp. This should be discouraged as the two are distinct entities and the former are subject to ulceration and malignant changes.

Next to myoma papilloma seems to be (7.8 per cent) the most common benign gastric tumor and were many of the so-called polypi examined histologically they would no doubt add materially to the number of recorded papillomata. Adenomatous characteristics sometimes change the microscopic appearance of the tumor to that of an adenopapilloma. This likewise should change our opinion of them as benign tumors since we are aware of the possibility of adenomatous structures undergoing malignant degeneration.

Papilloma seems to be on an average smaller than the myoma varying from a pea to a pear in size. The pyloric end of the stomach is more often involved than other areas. They may be pedicled as well as sessile. They are often multiple though only a few cases of papillomatosis are recorded. Males and females seem about equally affected. Forty to 50 years of age is the average age for their appearance though they have been noted at the extremes of 20 and 71 years of age. Malignant changes are observed fairly often and McCallum has remarked that those which he has seen in the stomach were associated with other tumors of a cancerous nature but that this was perhaps a coincidence and that they were of so soft and fragile a nature that losses of substance frequently occurred with hemorrhage from the remaining surface.

**Polypi.** Polypi are poorly named pedunculated tumors. The term is indicative rather of a gross physical characteristic than any histological morphology. Microscopical examination shows that every so-called polyp belongs to one of the many known pathological tumors. In the tabulated series many benign tumors have been included under this heading because they were diagnosed grossly as such and no histological examinations were obtainable. In view of the fact that many of the gastric tumors which have been carelessly designated as polypi by pathologists and surgeons and which later have been shown

histologically to be papillomata and adenomata (both of which are prone to malignant changes) an earnest plea is put forth for the discontinuance of this misleading and erroneous term.

**Adenoma.** They are benign tumors consisting of a central core of connective tissue with tortuous irregularly dilated tubular glands which are lined with cylindrical epithelium and well supplied by blood vessels and lymphatics. Over these is spread a thin layer of unstriated muscle tissue which in turn is overlaid by a greatly hypertrophied mucous membrane.

McCallum notes that the glands are partly cystic and longer than usual that they are embedded in a loose stroma and that because of traumatism they are constantly inflamed. When fibrous tissue predominates they are termed fibroadenomata.

Grossly the adenomata are round or lobulated projections from the interior of the stomach and may be single or multiple sessile or pedunculated. Cystic and carcinomatous degeneration occurs quite frequently.

In size they vary from a pea to a fetal head. Both sexes seem about equally affected. They are quite firm and frequently pedunculated. The lymphadenomata often have a creamy white color. The average age at which they occur is between 40 and 50 years. Adenomata however have been found in patients as young as 27 and as old as 76. Anatomically the pyloric end of the stomach and the lesser curvature are most often involved. Ulcerations occur and malignant changes seem to be recently noted more than formerly as a result of the more frequent microscopic examinations of all tumors. In proportion to other benign tumors they rank about 5 to 6 per cent.

**Cysts.** Seven varieties are commonly described. Of the various 31 that have been collected and that represent 5 to 6 per cent of the benign tumors 9 were gaseous, 5 were hydatid, 5 were hemorrhagic, 3 were dermoids, 2 were traumatic, 2 were degenerative, 1 was embryonic (?) and 4 were not classified. Degenerative cysts should when the type of tissue from which they are formed is known be classified as that tumor with cystic degeneration as a change or complication, i.e. fibroma with cystic degeneration, etc.

The recorded cases vary in size from that of a nut to tumors weighing 1 000 grams. Most often they are serous or subserous. Males are perhaps more subject to them than females. They may occur at any age depending on the nature of the cyst. A very young child has been reported and also a 73 year old man with a degenerative cyst.

A fluctuating palpable epigastric tumor steadily increasing in size following a history of an abdominal contusion should be regarded as a traumatic or hemorrhagic cyst. Retention cysts have been observed in cases of chronic gastritis due to obstruction of the gastric gland ducts.

**Lipoma** Microscopically the lipomata resemble those found in other parts of the body but sometimes they possess a few glands and muscle fibers when found in the submucous layer. They are lobulated and firm and though most often interstitial one has been noted with a pedicle. From the records it would be impossible to state what relation they bear to sex and age. They are much smaller than the myomata and usually vary between a hazel nut and a walnut in size.

The subserous variety seems twice as common as the submucous and according to Basch they are usually solitary situated mostly in the central part on the anterior wall and rarely undergo cystic or malignant degeneration.

**Fibroma** They may be single or multiple sessile or pediculated and are firm smooth and globular or elongated. They constitute about 5 per cent of the benign tumors and consist in the main of a fibrous tissue structure covered with mucous membrane. Their size varies from that of a pea to one that measured 12 by 6 by 4 centimeters. One third of the fibromata have pedicles the pyloric end is affected two to three times as often as the other areas. 60 per cent occurred in males 50 years of age seemed the average and 16 and 71 were the extremes noted. Perhaps their relative frequency of situation in the pyloric end is the reason they appear to simulate ulcer symptoms more than do the other types of benign tumors and also why ulceration of their surfaces occasionally occurs.

**Polyposis** This condition like that of the so-called polyp is a misnomer. Menetrier

described it as *poly adenome en nappe*. Once considered as quite rare it has now been found to be as common as the fibromata and more common than angiomata. Seventeen cases have been collected. As distinguished from multiple adenomata or papillomata the tumors are quite small very profuse often situated in a fairly compact or circumscribed area and with a hypertrophy and hyperplasia simultaneously of all the gastric glands more or less. The condition seems quite prone to ulcerative and malignant changes and the prognosis is not very good. They should be classified according to their microscopic characteristics under the respective headings of adenomata papilloma etc. which they are as adenomatosis gastrica papillomatosis gastrica fibromatosis gastrica etc.

**Angioma** Angiomata are generally single smooth soft fair sized (nut to an orange) and bluish black or reddish tumors which are frequently submucous situated toward the body of the stomach and chiefly found in the anterior or posterior wall. A feeling similar to that of finding a mass of worms has been commented on as has also the fact that they are occasionally associated with similar tumors throughout the gastro intestinal canal. They occur at varying ages and do not as yet seem to be confined greatly to any one period. They

TABLE I—FREQUENCY OF DIFFERENT TYPES OF BENIGN GASTRIC TUMORS

Tumor	Cases Number	Cases Percent	Cases Percent	Cases Percent
Myoma	3	57.3	4	8
Papilloma	44	7.8	16	3
Fibrosarcoma	33	5.8	6	3
Adenoma	3	5.5	5	1
Cyst	9	5.7	1	
Lipoma	25	5		
Fibroma	23	4.2	6	
Lymphadenoma	4	5		
Papilloma		9		2
Angioma		7		
Myoma	3	5		
Osteoma		7		
Osteochondroma		7		
Unclassified		9		
	560		5	

\*The above records are from the body of the stomach. The pyloric end is included in the total. The cases of polyposis are included in the total. The cases of polyposis are included in the total.

†Best described by Menetrier. These were included under the heading of polyposis.

TABLL II—AUTHORS CASES

Case	Se	Ag	Le	Loc ion iz d w ght	Ch if tur
	M	58	Adenomata	Scattered 1 to mm (many)	Gastric symptoms Also carcinoma of oesophagus t autopsy
2	M	65	Ad omata	Not stated Not stated	Discovered tautopsy Bronchopne monia
3	M	6	Adenomat (pedicle)	Pyloric end 1 cm diameter	Chronic enteritis Autopsy finding
4	M	76	Adenoma	Pyloric end Small	Pulmonary oedema Autopsy Microscopic adenoma and chronic gastritis
5	M	50	Adenomata	Lesser curvature and posterior wall Very small (very many)	Gastric symptoms indicated Di gnosis carcinoma of oesophagus Autopsy macro adenoma chronic gastritis with benign malignancy
6	M	5	Lipoma	Submucous fundus	Lobar pneumonia Autopsy
7	F	85	Mycetozoa (sclerous)	Serous surface 5 mm (many)	Death of chronic myocarditis Autopsy cerebral mycetozoa of intestines also fibroma mucosa of body
8	F	50	Fibromyoma	Pyloric end Pea	Cerebral haemorrhage Autopsy
9	F	6	Fibrolipomyoma	Lesser curvature Pea	Chronic interstitial nephritis Autopsy
	M	51	Fibrolipomyoma	Greater curvature 8 mm	Lobar pneumonia Autopsy
	M	7	Fibromat (calcified)	Greater curvature Sclerous	Operation for cholecystitis Pulmonary oedema Death Autopsy findings
12	F	60	Fibromata	Fundus Pea (sclerous)	Lobar pneumonia Autopsy
13	M	49	Fibromata	Pyloric end Small ( )	Pulmonary tuberculosis Autopsy
14	M	65	Fibromat	Fundus Small	Chronic pleurisy Emphysema Autopsy
15	M	58	Fibromat (pedicled)	Pyloric end Serous surface sized 4 by 12 cm	Chronic symptoms 6 yrs similar to malignancy X-ray 2 hospitals in 3 yrs Malignancy Death Autopsy fibromat acute catarrhal gastritis no carcinoma
16	M	73	Cyst (fibromatous)	Not stated Autopsy	Death of pneumonia Autopsy
17	M	45	Cyst (haemorrhagic)	Pyloric end 8 mm	Autopsy
18	F	68	Papilloma	Neoesophagus	Cerebral haemorrhage Autopsy
19	M	52	Papillomata	Pyloric end Not stated (many)	Chronic oesophagitis Ulcerative enteritis Autopsy
20	F	67	Papilloma (pedicled)	Pyloric end 8 mm	Cholelithiasis Acute regurgitation Autopsy
21	M	49	Papilloma	Pyloric end 8 mm	Organic dementia Autopsy
22	F	69	Papillomata	3—greater curvature—pyloric end 3—small 1.6 cm	Cerebral haemorrhage Autopsy



TABLE II—AUTHORS CASES—C continued

Case	Sex	Age	Lesion	Location and Size	Clinical Features
23	M	1	Papillomata	Scattered 8 to 10 mm (p l c)	Bronchopneumonia Autopsy
24	F	46	Papillomata	Pyloric end Small ( )	Crdial dilatation Purpura hemorrhagica Autopsy
25	M	46	Papilloma	Pyloric end Grape	Ruptured dissection of cecum Autopsy
26	M	65	Papilloma	Pyloric end Small	Autopsy Histologic examination showed chronic hypertrophic gastritis
	M	65	Papilloma with pedicle	Middle of greater curvature 1 cm	Aortic regurgitation hydrothorax autopsy histologic examination of papilloma and cholecystitis
28	F	65	Papilloma with pedicle	Pyloric end 8 mm	Splenoflectomy and resection Autopsy
29	M	45	Papilloma (pedicle)	Pyloric end	Symptoms ulcer, anastomosis, hemorrhage, diarrhea, melena, and anal calculus Operation Histologic examination of papilloma with adenocarcinoma
3	M	45	Papillomata	Posterior wall of great curvature Cherry	Symptoms Papilloma of stomach Operation Papilloma of stomach Histologic examination of papilloma of stomach
31	M	44	Papilloma (pedicle)	Pyloric end 3 by 2 cm (ribbed like)	Pancreatic adenoma X-ray retention Diagnosis of ulcer Operation Papilloma of pyloric end of stomach Histologic examination of papilloma with carcinoma
32	F	6	Papilloma (pedicle)	Anterior wall 5 cm long	Duodenal symptoms Operation Cystic ulcer of pylorus Histologic examination
33	M	5	Papillomata	Diffuse Pear-grape	Symptoms X-ray Operation Gastric ulcer, hemorrhage, and perforation of papillomata Histologic examination of papillomata with ulcer Pyloric stenosis
34	M	4	Pyloric (pedicle)	Pyloric end 15 mm	Intestinal obstruction Autopsy
35	M	60	Lipoma	Pyloric end Cardiac (diffuse)	Stenosis of esophagus, retropharyngeal abscess, and retropharyngeal abscess seen gastroscopy and stenosis of retropharyngeal abscess
36	M	69	Pyloric with pedicle	Pyloric end 1 cm (3)	Bronchopneumonia Autopsy
37	M	58	Pyloric	Pyloric end 8 mm (serosal)	Crdial dilatation Autopsy
38	F	49	Lipoma	Pyloric end (2)	Hypostrophic anemia Autopsy
39	M	60	Lipoma	Pyloric end 5 to 7 mm (serosal)	Lobular pneumonia Autopsy
40	M	49	Pyloric	Esophageal end 8 mm	Dilatation of esophagus Autopsy
4	M	77	Pyloric	Pyloric end 5.8 mm ( )	Empyema Autopsy
4	M	75	Pyloric	Pyloric end	Pulmonary tuberculosis Autopsy Polyp of stomach

TABLE II—AUTHORS CASES—Continued

Case	Sex	Age	Lesion	Location & weight	Clinical features
43	M	42	Polyp	Pyloric end 8 mm (pe) (several)	Pulmonary tuberculosis Autopsy
44	M	56	Polyp	Pyloric end 6-12 mm	Hepatic cirrhosis Autopsy
45	F	8	Polyp	Middle of greater curvature 3 cm	Chronic myocarditis Autopsy
46	M	75	Polyp	Middle of stomach 2-3 cm	Insane Autopsy
47	M	56	Polyp	Lesser curvature 2 cm diameter	Gastric complaint for years X-ray carcinoma Autopsy polyp and carcinoma Histological examination carcinoma polyp not sectioned
48	F	81	Polyp	Middle of greater curvature 3.3 cm	Chronic myocarditis Autopsy
49	M	65	Polyp	Not stated Small	Myocarditis cellulitis of leg Autopsy
5	F	49	Polyp	Not stated (pyl) (c?) Marble (a)	Gastric symptoms for years pointing to malignant Autopsy polyps but no carcinoma

ulcerate easily and hæmorrhages are apt to occur. Two have been noted with a pedicle though they are most often interstitial. Lemon reports a case with sarcomatous changes.

**Myxoma.** Myxomata are generally gelatinous, encapsulated and semi-transparent tumors situated in the walls of the stomach and covered by mucous membrane. They are uncommon and no doubt due to myxomatous degeneration of myxomata or other tumors.

**Osteoma.** Osteomata are exceedingly rare tumors. Wade reports a doubtful osteoma and Eerkles an osteochondroma of the gastric wall.

**Lymphadenoma.** According to Deaver and Ashhurst Gilly collected in 1856 51 cases of gastro-intestinal lymphadenoma, the stomach being involved in 14 instances. A few cases have been recorded since. In all known cases lymphomatous growths have been observed in other parts of the body as well as in the spleen, lymph nodes, bones, pharynx or intestines. In all cases of gastric lymphadenoma the intestines were involved. This affection arises either in the subserous or submucous lymphatic tissue of the stomach. In the submucous

tissues it exists either as a localized or diffused form usually manifesting itself on the surface of the stomach by a polypoid condition of the mucosa. Ulceration is more usual in the circumscribed form. The tumors which arise in the submucous tissues rarely cause obstruction.

TABLE III—SUMMARY OF AUTHORS' 50 CASES

	Case	P	T
Polyp	6	32	
Pillomat	6	2	
Adenomata	5		
Myomata	4	8	
Fibromata	6	2	
Cysts	2		
Lipoma	1	1	
Pylorus	1	2	

Th. umm. y. lys. f. h. th. ase. (T. bl. I.) se. ms. t. w. d. va. i. with. b. t. f. th. collected cases (T. bl. I.) W. sorry. th. mucous p. al. xam. von. only. w. f. il. th. oc. d. of th. 5 cases. g. l. th. xam. co. erned. ly. h. l. or. malig. tion. Of th. mbe.

s. w. d. m. ta. (s/ 6) P. ce. t. w. rap. l. m. ta. 5. 5. w. f. br. mata. 5. w. m. ta. 6. 5. w. cyst. 6. 5.

If d. th. so-called 'polyps' be. h. tolog. lly. xam. d. h. y. w. l. d. rally. h. l. d. b. pe. t. g. l. m. types. d. m. de. ce. rate. class. t. u. mor. pos. b. c. pe. b. b. h. w. ing. de. mata. d. pap. l. l. o. m. a. t. b. pred. m. t. g. y. w. e. l. must. be. remembered. th. t. g. m. p. a. r. a. ly. f. w. f. th. case. i. the. lly. c. i. s. e. w. xam. ed. mucous. p. u. c. lly. d. th. ur. te. la. f. l. l. mor. pos. b. i. on. l. w. th. pe. o. l. e. s. t. th. ry. mor. mor. d. b. e. s. e. c. t. i. o. n. d. b. t. o. l. o. g. i. c. a. l. y. d. p. o. r. e. d.



Sum 143 of c m p l i c a t i o n ( b d o m a l )

Ca tritis	3
Carcinoma of stom ch	3
Ulcer	1
Ch lei thiasis	2
Re al calcul	1
Intertis	
Ch r s i l l i	1
Carcinoma of oesophagus	1
Stric t e of oesoph gu	

C m m r y of ages

C r s P t

0 t 30 y rs	2	4
30 t 40 y rs		0
40 t 50 year	12	24
50 to 60 year		20
60 to 7 year	16	3
70 to 80 years	7	14
80 to 90 years	3	6

These 12 u f y z of oc urr e f m o r e b t t h t h  
d g m e d h b b y d t p s y i n m o s t s e p r o u s l y

but those commencing in the subserous tissue which are usually diffuse frequently penetrate paralyze and ultimately destroy the muscular coat producing dilatation of the stomach and consequent stagnation of food. In some cases it appears to have been demonstrated that the disease originated in the neighboring mesenteric lymph nodes and subsequently involved the subserous lymphatic structures of the stomach.

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A CONSIDERATION OF THE CERVIX UTERI FROM THE  
STANDPOINT OF ITS SPHINCTER PROPERTIES

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PROBABLY it is safe to say that the cervix is the commonest seat of chronic infection in the female anatomy. Few women and I believe no parous women go through life without some degree of infection stored away in those tortuous cervical glands. As would be expected in this age of hyperactivity concerning focal infections much has been written from a clinical standpoint on cervical infections acute and chronic and their treatment. Numerous articles by the outstanding men of the profession and others show that much study has been applied to the clinical treatment of this organ so prone to misfortune. The thing that strikes one most forcibly I think is the fact that these brilliant minds working with one common aim in view—the eradication of infection in this area—advocate such widely varied methods. One emphasizes amputation another radium another suction and active hyperæmia another cautery and so on through a seemingly never ending list of methods.

It was recently our privilege to visit some 250 of the leading hospitals of northeastern America and as I was particularly interested in gynecological and obstetrical problems perhaps special attention was paid to those phases of the work. The impressions gained from my observations as to the treatment of chronic endocervicitis are here offered for the consideration of the profession in the hope that a lesson may be learned even from very chaos. These impressions are the result of visits not only to the smallest hospitals in the outlying districts but to the largest clinics in the medical centers of our land.

As in our studies so in our observations we are struck first of all by the very multiplicity of methods seen. Various local applications tampons operations of every description cauteries and occasionally radium are advocated. There seems to be an entire lack of unity of opinion in a given district city and sometimes even in the same clinic. Every

surgeon we talked with was a law unto himself in the matter. He seemed quite satisfied with his own method of procedure and he quoted his results in substantiation.

Especially is one impressed we think with the enormous amount of surgery everywhere performed on the cervix and on patients of all ages for various reasons and by diverse methods. Trachelorrhaphies are apparently done oftener in the smaller towns than in the larger cities. Everywhere however amputation is rampant. The methods of amputation are many ranging from the old Schroeder with all its modifications to the newer Sturmdorf method with all the modifications which must naturally evolve therefrom. It was a distinct surprise though to find a comparatively small number of surgeons throughout the country using the Sturmdorf amputation or any modification of it.

The electrocautery was then only in the process of introduction in the larger clinics. It was being advocated in those cases of chronic cervical infection without complications i.e. with no indications for surgical interference elsewhere. Otherwise straight surgical procedures on the cervix were employed with exclusion of the cautery.

Radium as a curative treatment for chronic endocervicitis was being used in only a few of the larger clinics.

Decidedly at sea and in a seeming maze of treatments we were privileged to discuss our perplexity with an eminent professor of gynecology and obstetrics in a well known University. His remarks will always be remembered and they are really the basis of this study. He said: Always keep in mind that the cervix uteri has all the properties and duties of a sphincter and treat it with the same consideration and reverence you would a sphincter elsewhere in the body. You will then approach the cervix with the proper attitude. The statement is to me an inspiration and though its anatomical and

physiological accuracy will undoubtedly be questioned by many it provides we believe the proper attitude for the rank and file of our surgeons

Chronic endocervicitis if at all marked demands treatment and if possible cure Its presence may cause discomfort physically and mentally may be a focus of infection causing trouble elsewhere may cause sterility As treatment then is a necessity in many cases is there no hope that some degree of uniformity of treatment may be established? Why should there be a multiplicity of methods in vogue as there is at present? Many of the methods doubtless accomplish their purpose but many not only fail but do infinite harm

It is believed that the answer lies to a great extent in the fact that the cervix as an organ has been neglected in the past by university teachers and those who guide the channels of medical thought Too long has the cervix been considered as merely the neck of the womb a passageway of decidedly passive interest except during the first stage of labor or in the presence of leucorrhœa

As far as can be ascertained after diligent search with the aid of the library research department of the American College of Surgeons every standard or recognized textbook in the language whether anatomical histological physiological pathological or clinical is content to describe the uterus in detail and allow the student to consider the cervix as subservient and merely adjunct The histologists apparently show the most respect then the pathologists the anatomists practically ignore it and the physiologists disregard it completely Small wonder then for the lack of reverence

It is our intention to consider the cervix as a separate organ which is so highly specialized as to border on the mysterious and which performs a function indispensable to the continuation of the race That function must surely be based on anatomical and physiological principles and a knowledge of these principles is essential to understand the function of the cervix A knowledge of cervical function is essential in the prescribing of treatment

## IS THE CERVIX A SPHINCTER

One is well aware that a number of authorities do not consider the cervix a sphincter Probably this is the general trend of opinion today This argument is based chiefly on the anatomical fact that there are no circular muscle fibers which completely encompass the cervix Uterine muscle fibers sweep down at least schematically from an origin near the bases of the fallopian tubes and by a series of spirals partially encompass the cervix but no single fiber completely surrounds it We believe that the whole cervical musculature is probably thus made up Therefore as every muscle fiber contracts toward its fixed point the base of the fallopian tube the cervix as such is devoid of function and physiologically is nothing more than a passive communicating duct between the vagina and uterine cavity proper (Sturmdorf)

This theory of cervical musculature has always appealed to me as far as it goes We visualize that form of a tobacco pouch which is made in the shape of a bag with the sides pressed into spiral folds in such a way that a turn to the right causes the fold to fit together and the bag collapse shut by an opposite turn the bag is opened and the contents can be removed

We like its application to the first stage of labor How nicely it explains the drawing up of the cervix the obliteration of the internal os the gradual thinning out of the lower uterine segment and the resulting dilatation To apply the above however to the 6 months immediately before labor is not so easy It is satisfactory as far as it goes but it does not go far enough The utterly passive nature of the cervix of the pregnant uterus is questioned the cervix is and should be so considered an organ capable of function and with a remarkable work to do

## PHYSIOLOGY

The uterus like the heart and indeed all hollow muscle organs of the body is fundamentally myogenic in action that is the source of the action of the uterus is placed in the muscle itself Its function as in the heart may be described as rhythmicity excitability contractility conductivity and tonicity

In other words the muscular fibers of the uterus possess the power of rhythmically creating a stimulus of being able to receive a stimulus of responding to a stimulus by contracting of conveying the stimulus from muscle fiber to muscle fiber and of maintaining a condition called tone.

Now in the normally functioning pregnant uterus there are two natural forces acting on the gestation (1) the force of gravity (2) intra uterine pressure. The first force is constant and gradually increasing the second is regularly intermittent depending on the rhythmicity of the uterus as to time and in the other four functions as to length and severity. The force of gravity in the human is unfortunately directed against the one vulnerable point in the uterine armor—the cervix. The cervix of no other vertebrate has this force with which to contend. Is the cervix then an entirely passive organ subjected constantly to the two forces above described? Before arriving at a conclusion we must first deal with that little understood phenomenon of smooth muscle—*contraction tone*.

Concerning the tonicity of voluntary or striated muscle a good deal has been learned. We know that voluntary muscle will react to tonic contractions for a certain length of time and will finally become exhausted and cease to function. We know that voluntary muscle is wholly dependent on impulses from the central nervous system to preserve its tone or set it into activity.

On the other hand involuntary or smooth muscle possesses an automatic tone and activity manifested in rhythmic contraction and relaxation entirely independent of the central nervous system. Smooth muscle will react to impulses from the central nervous system it is true but it is only reflex action not voluntary control. Smooth muscle retains its tonic activity indefinitely regardless of nervous impulse. Voluntary muscle cannot. The tonicity of smooth muscle goes on indefinitely we believe without appreciable expenditure of energy or resulting exhaustion. This is known as the smooth muscle tone phenomenon or unvarying minimal contraction peculiar to smooth muscle. Probably nowhere in the body is the smooth muscle tone phenomenon so well seen

rising to meet an emergency as in the pregnant uterus. Its expression is the well known

Hegar's sign. It is one of the very earliest signs of pregnancy. Hegar's sign though an apparent softening of the lower uterine segment is in truth a smooth muscle contraction with resultant neighboring lymphatic engorgement. It does not appear at any exact invariable location. Like the internal os it is without anatomical or histological definition but with a definite physiological alignment.

Here is nature's defense against the continuous attack on the gestation of gravity and intra uterine pressure. We must remember that the gestation is in a sense a foreign body. It has arrived without warning the uterus being given only some 3 days to prepare for its reception. It grows with remarkable rapidity and yet almost no attempt is made by nature to bolster up the musculature of the lower uterine segment by hyperplasia or by hypertrophy.

The intra uterine mechanism of the gestation membranes amniotic fluid fetal suspension etc. is too well known for elaboration here. It serves a great purpose in its demand for an even distribution of pressure over a large area but it is not enough in itself to offset hernia of uterine content. The mighty factor is the smooth muscle tone phenomenon manifested in the region of the internal os and termed Hegar's sign.

The old contention that the elastic tissue in the cervix had much to do with its sphincter properties was made the object of study. Elastic tissue is found in some abundance around the arteries to a less extent around the veins and very occasionally between the muscle fibers. It was found in just about the same quantity in the corpus as in the cervix. The cervix of the pregnant uterus showed apparently no more than the cervix of the non pregnant uterus. It was felt that the elastic tissue content of the cervix was of importance only from a circulatory standpoint.

#### 4. THEORY

That the remarkable extent and duration of smooth muscle tone is almost unlimited is shown by the action of the adductor muscle of the bivalve mollusc. Such strength is



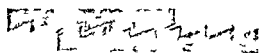


Fig. 1. Diagram to illustrate a catch and ratchet mechanism. The upper fiber can be pulled in the direction of shortening and the latter then is shortened. The lower fiber is not pulled and the upper fiber cannot be separated (from Hays).

known to every one who has opened an oyster. The exact figures are irrelevant. It is sufficient to say that this muscle one third quarter centimeter in cross section can withstand a force of pounds over a period of days *without evidence of fatigue* (6).

Consideration of such facts led Kutzner (3) to suggest that the muscle fibers cannot be exerting tensile stress by a continuous excitatory process but that the fibers must be hooked up in some way by a kind of arrangement similar to a ratchet and kept in a position to which the shortening process brought them (1). The theory of the catch or ratchet mechanism of smooth muscle is best explained by the accompanying illustration (Fig. 1). It is only a theory but an interesting one. It explains fully the ability of the cervix to withstand the forces to which it is subjected. Yes and probably ten times their combined forces. That elusive inhibition by which the catch is removed is wrapped up in the veil of phenomenon labor.

It is probable that most surgeons in dilating cervixes have tried to hurry the procedure with powerful Goodell or Bosworth dilators or weapons of a similar ilk. It is true that the instruments do add speed to the procedure in that one can often dilate a cervix enough to admit a finger or forceps in 10 or minutes. But how many have also experienced in their hurry that sudden sickening relaxation of the cervix that feeling as though something had torn through or given way. We have had it happen to us and we have seen it happen to one or two of the best known men in the land.

It is here contended that such pressure has been put on the musculature of the cervix as

is put on the bivalve mollusc with the oyster knife. That the intricate ratchet mechanism of the muscle has received such pressure as to overcome all opposition and literally tear the mechanism of the cervix to pieces.

Just how much permanent damage has been done is not known but it is probable that the ability of the patient to carry subsequent pregnancies to a successful conclusion is very much diminished even if it may be impossible.

With the graduated dilators the cervix is dilated by degrees over a period of time and the musculature responds by degrees as any muscle will. It is a longer procedure, it is true but surely time is of little account. Nature would take about 1 hour to dilate a cervix to the size of a 25 cent piece. Surely man has the patience to take at least a third of that time.

Regarding amputation of the cervix if there be anything in our theory it is very evident that the removal of any quantity of cervical musculature is going to ruin irrevocably the ratchet mechanism and make subsequent pregnancies certain failures.

Two or three facts must then be kept in mind regarding (a) the anatomy and histology of cervical glands (b) the usual pathology of cervical glands and (c) the most conservative operation that will accomplish two things (1) the eradication of infective glands and (2) the conservation of the cervical musculature.

a. The cervical endometrium with its numerous branching racemose glands has been well exploited in the past. Much emphasis has been placed on the fact of the branching as compared with the simple tubular glands of the corporeal endometrium (as a matter of fact many uterine glands branch). Perhaps much more important are the facts that (1) the glands are racemose, i.e. have blunt bulbous terminations resembling grapes (2) that the glands taken singly narrow in lumen as they approach the cervical canal so resembling roughly a beaker such as chemists use (3) that the glands secrete a thick tenacious mucus which is excreted normally with some difficulty and that the glands are readily plugged by inflammation infiltration and swelling at their gland mouths. In contrast the uterine glands secrete a thin watery fluid readily excreted.

b An important factor to keep in mind is that endocervicitis is confined in great part to the cervical endometrium and the parts immediately adjacent. The racemo e termination of the gland is often infected it is true but by no means always and in any case the glands rarely extend beyond a depth of 3 millimeters at the external os and at the internal os there are very few glands and the penetration is very shallow. The resulting infection is almost nil then in the region of the internal os.

c It is felt that in view of these factors the coming out process as first advocated by Sturmdorf and later modified by many is the operation of choice. It both eradicates and conserves.

The cervix is really not a sphincter. Probably its entire musculature finds origin in the corpus uteri. Systole and diastole of the cervix is then identical with that of the corpus only slightly later in time. It is contended though that the cervix has the *properties* of a sphincter and that is the important thing after all.

The object of this paper is not to attempt an explanation which will finally decide the wondrous mechanism of the cervix uteri nor

to evolve a panacea for all its ills. It is hoped merely that a little more consideration will be accorded an organ the treatment of which as observed in hospital in over half a continent borders on abuse. The cervix is in a position remarkably strategic. It is the gateway to the citadel the barrier between the aseptic and the ever septic the dividing line between things mundane and the great unknown. It accepts or rejects the morbid bacteria or the vital sperm seemingly at will. The ovum is not fertilized or if it is the uterus is unable to carry the conception on to maturity. Should we not emphasize again the remarkable position it holds and the part it plays in the female genital tract. It is only through such knowledge that we acquire the proper reverence and through it the proper attitude.

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## SARCOMA OF THE UTERUS

### REPORT OF A CASE WITH REVIEW OF THE LITERATURE

By J C BUNTEN M.D. F.A.C.S. AUGUSTA KANSAS

**S**ARCOMA of the uterus is a subject which requires consideration owing to the fact that in the last few years the condition is being found with increasing frequency. This increase is probably due almost entirely to the better diagnostic method and the more universal pathological study of both gross and microscopical myomatous growths of the uterus after operation. While I may repeat some of the statements of other writers the subject is of sufficient importance to warrant the repetition.

In regard to terminology the following names have been used to designate this type

of tumor sarcoma myosarcoma leiomyosarcoma myoma malignum, malignant leiomyoma blastoma, malignant leiomyoma and malignant myoma. I am of the opinion that sarcoma or myosarcoma would be the more appropriate name.

Uterine sarcoma was first described by C Mayer in 1860 and later confirmed by Virchow in 1867. In 1867 G Veit devoted a portion of a chapter in his work upon diseases of women to the affection describing 3 cases of his own including 1 case of sarcoma of the cervix which is the first on record. In the next 5 years a number of cases were reported

in Germany. In 1894 Williams wrote an excellent article on the subject collecting all the reported cases up to that time numbering 144. In April 1923 Macon again reviewed the literature in a very interesting article. Between 1894 and 1923 about 200 cases were reported. From the date of Macon's article to the present time I find 9 cases reported including 1 of my own. This makes a total of 353 cases in the literature.

The etiology of sarcoma is at present unknown so there is little to say on this topic. Statistics show the average age of patients with very malignant tumors to be 50 years and all other type of cancer 49½ years. In the United States in 1916 34 per cent of all deaths in women was due to malignant tumor of the uterus. These were mostly cancer.

Zacherl states that the proportion of non-epithelial malignant tumors of the uterus to carcinoma is 1 to 40. Evans from the Mayo Clinic record for the period from 1910 to 1918 22 borderline and malignant non-epithelial tumors of the uterus while there were 873 carcinomata for the same period which is the same proportion as that stated by Zacherl.

Sarcomata of the uterus may be divided into three groups: (1) those originating in the mucosa (2) those originating in the parenchyma (3) those originating from the cervix.

From Knott's study of 118 cases 33 were of the first class, 46 of the second class and 29 of the third class. A question of importance is do sarcomata originate from pre-existing fibroids? Most observers seem to believe they do. Maroney states that diagnosis must be a matter of individual interpretation in suspicious cases. A composite picture of characteristics as presented by several authorities includes the following points:

1. Increase in size of tumor cells as compared with normal muscle or benign muscle tumor cells.

2. Shorter and plumper cells with nuclei more nearly oval than normal muscle or benign muscle tumor cell rounded and vesicular nuclei.

3. Inequality in size and irregularity in shape and arrangement of the cell.

4. Lack of differentiation of the cell.

5. Unequal staining of nuclei and deeply staining nuclei.

6. Presence of immense cell (protoplasmic plaques) with hyperchromatic single or multiple nuclei (giant cell).

7. Presence of mitotic figures typical and atypical.

8. Decrease or absence of stroma fibers between the cell.

9. Thinner or absence of vessel walls.

Kelly and Cullen seem to place definite dependence on inequality in the size and increase in the size of the tumor cell and do not look upon the presence of mitosis as essential to the diagnosis of malignancy in the tumors.

Iwing says the round cell and the giant cell in the most malignant. Proper and Simpson agree and state that in doubtful cases the absence of mitotic figures is a criterion of a benign tumor. Mallory believes the presence of mitotic figures is a definite indication of malignancy.

Evans stated that of the 72 cases reviewed at the Mayo Clinic the number of mitotic figures present was in direct proportion to the malignancy of the growth. In 13 cases mitosis was a very common finding, averaging 200 to 1200 mitotic figures for each cubic millimeter. Eleven of the 13 patients were known to have had recurrence within 18 months. In 11 cases mitotic figures ran from 200 to 800 for each cubic millimeter and in the remaining 48 cases few or none were found. In both of the latter groups the end results were excellent and as far as Evans was able to determine there had been no recurrences. Mas on states that there is no doubt that mitotic figures are a common finding in the more malignant types of sarcoma.

I am sure that when we consider the proportion of myomata that are malignant we will find that a more careful study of these tumors after removal is essential. From the following statistics one can safely state that in about 2 per cent of all myomata malignant changes take place. Sarcomata of the endometrium constitute about one third of uterine sarcomata. Sarcoma of the wall occurs either in the myometrium (mural) or more often in a

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Mill	9	0	0	0
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Olish	1	4		

fibroid Noble claim that 2 per cent of all fibroid show malignant changes which agrees with the above table. Melanotic sarcoma is never primary in the uterus.

It is interesting to note the occurrence of combined tumor that is a sarcoma and a carcinoma in the uterus of the same case. Moore states that the combined tumor are rare. Virchow peak of a carcinomatous degeneration of a uterine sarcoma. Palmer Findley in an article in 1903 discussed the combined malignant tumors of the female genitalia. A more recent article is that of R. H. Jaffe in October 1913 in which he states that the combination of sarcomatous and carcinomatous tissue may be due to the growing of a carcinoma and a sarcoma into one another both of them taking origin in different parts of the same organ or they may arise from the same place. The name sarcocarcinoma should be used only for this latter type of tumor.

There are three possibilities to explain the histogenesis of these tumors (1) the carcinoma may have been the primary tumor the stroma of which changed into a sarcoma (2) the sarcoma may have been followed by the carcinoma or (3) both tumors may have developed at the same time. Most of the tumors formerly reported as sarcocarcinoma are surely pure carcinoma with partly sarcoma like appearance of the tumor cells.

I have found 13 such cases reported in the literature and will mention them as follows:

Case reported by Jaffe

A round cell sarcoma in the mucous membrane of the corpus. Underneath this tumor were carcinomatous cells (Gebhard).

A woman expelled two necrotic tumors the size of a man's fist which were round cell sarcomata. At autopsy the cavity of the uterus contained typical alveolar carcinoma (Rabl Ruckhard).

Curettagage revealed an alveolar carcinoma and 2 days later there was expelled a tumor the size of goose-egg which was a vascular spindle cell sar-

coma. There was also a fibroid and a polyp of the corpus and cervix (Rabl Ruckhard).

A round cell sarcoma of the corpus the size of a fist was removed and recurred. There were carcinomatous cells in the tumor (Klein).

A sarcomatous polyp of the corpus. Over the remaining surface of the corpus was an alveolar carcinoma (Emanuel).

A sarcomatous polyp in the corpus (round cell). In the upper segment of the cervix was an alveolar carcinoma (Von Francke).

A spindle cell sarcoma the size of a walnut in the corpus. Higher in the fundus was an adenocarcinoma (E. Opitz).

A sarcomatous polyp of the cervix and a alveolar carcinoma of the corpus (Amann).

Degenerate sarcoma with multiple carcinomatous growths (Lagrange).

An adenofibroma of the uterus the upper portion of which was carcinoma and the lower portion sarcoma (Ivanoff).

Carcinomatous degeneration of a cervical polyp. Hysterectomy was followed by a sarcomatous growth at the base of the broad ligament (Findley).

I wish also to make mention of the article by Tausig in 1914 in which he had reviewed the literature up to that time and found that out of 141 cases of tumors of the round ligament were sarcoma.

#### SIGNS AND SYMPTOMS

From the standpoint of diagnosis there is nothing in the history or physical examination which makes it possible to suspect malignancy except in advanced cases where operative cure is hopeless. Distant metastases do not seem to occur in these cases. Recurrences are all local. The symptoms are not definite. In general they are those of carcinoma. A watery or blood tinged vaginal discharge bleeding menorrhagia and metrorrhagia occur in one half of the cases. Other evidences are menorrhagia during the menopause pain in the tumor independent of menstruation and an abundant thin watery discharge after the menopause which does not lessen with the progress of the disease. Soft masses may escape in large quantities from the uterus. In adolescents the youth of the patient may be suggestive as myoma in these cases would be rare. The uterus is softer and less resistant it increases in size more rapidly and to greater degree than with carcinoma. Pain is more prominent than in carcinoma.

## PATHOLOGY

The pathogenesis throughout the course of the disease is the picture of metaplasia characterized by early malacia (osteodystrophia juvenilis<sup>2</sup>). At operation no changes in the soft parts are observed grossly when the incision is made to expose the bone lesion. The periosteum is quite easily freed from the bone. A gray almost white cortex is revealed with the appearance of a structure the vitality of which is lowered. When the bone surface is scratched with a curette there is not that ensation of dragging back on the curette noted in normal bone. The cortex is easily crushed. When the bone canopy is penetrated the contents are usually found to be fluid thin or gelatinous and yellow or reddish in color according to the amount of blood present.

Microscopic evidence of metaplasia has cast suspicion on the benignity of the disease. Witness the remarks of Bloodgood (5) that in almost all of his cases of bone cysts with osteitis fibrosa he has found cellular areas with spindle cells or round cell. The spindle cell are apparently of the connective tissue type which ultimately form fibroblasts and fibrous tissue and the round cell are either osteoblasts which have not yet formed bone or cells which arise from proliferation of the endothelial cell of blood vessel. The microscope shows a tissue made up of cellular fibroblastic framework with delicate bone trabeculae embedded in it and if the lesion is near the epiphysis a circumscribed area of hyaline cartilage may be found even grossly. The finding of hyaline cartilage in the cysts probably gave Virchow his basis for concluding that osteitis fibrosa cystica resulted from liquefaction of a chondroma. Bloodgood (4) hints that the finding of the cystic area near the epiphysis suggests the likelihood of disintegrating cartilage in the lesion also the cartilage is not present in sufficient quantity to justify the conclusion of an original cartilage mass. The walls of old lesions are lined with a fairly dense connective tissue membrane the fibers of which are concentrically arranged and bounded by short strands. No true endothelial or epithelial lining is present. The fibrils of connective tissue have few

nuclei and only a moderate number of blood vessels are seen throughout the fibrous portion of the mass. Some areas are infiltrated with round cells and resemble granulation tissue which may be confused microscopically with small round cell sarcoma. Resorption of marrow and bone goes on with this new formation differing from the normal in that osteoclastic giant cell often remain and may gather in clumps. Perhaps because of some defect in calcium deposit the usual course is that the tissue remains in the osteoid stage instead of going on to form normal bone. True malacia occurs. In patients who recover spontaneously or who recover after non surgical treatment as has been reported (7) or those in whom the bone structure appears normal in the X ray examination after a long period the probable defect with respect to calcium metabolism has been corrected and the bone forming process has resumed its normal function.

## DIAGNOSIS

The result of X ray examination while unsupported is not conclusive yet it is reasonably characteristic and the most reliable aid to diagnosis. Murphy (23) as early as 1913 remarked that in cases of fibrocystic disease the diagnosis may as well be made by X ray examination as with the microscope. As a matter of common experience the surgeon who depends upon frozen sections for diagnosis in bone tumor of central origin will come to grief. For example in a number of Bloodgood's reported cases in which tissue was sent to the laboratory for study a diagnosis of sarcoma was made from the frozen section while further study and the patient's clinical course showed the lesion to be benign. The basis of the primary report was presumably the misinterpretation of metaplastic forms for those of malignancy.

Acute bone lesion with definite etiology give little difficulty in diagnosis and are not considered in this discussion. The central bone tumors with cyst formation to be considered in making a presumptive diagnosis are osteitis fibrosa cystica giant cell sarcoma myxoma chondroma and sarcoma. These are eliminated by the rules of probability the clinical facts and X ray finding. The

pre operative findings are of no value in deciding the consistency of the lesion whether liquid solid or lined with a membrane but that is not essentially important. Reliable pre operative evidence enables the surgeon to make a presumptive estimate of how extensive his work is going to be and to make a reasonable prognosis concerning the benefit the patient will gain from an operation.

Myxoma and chondroma of bone are equally rare comprising together about 8 per cent of all central bone tumors. Although the site of predilection is the bones of the hands or feet other bones may be affected. Ewing writes with regard to chondroma. The X ray shows osteoporosis of the ends of the bones and often a cystic appearance while the compact bone of the ends of the shaft may be very deficient. At various points usually about the joints the multiple outgrowths appear. The structure shows a persistence and over growth of poorly ossified or calcified cartilage in which the cells are irregular in size and form (Carmen Fisher). The ordinary epiphyseal line is irregular or obliterated. The central myxoma absorbs the shaft and periosteum and invades the soft tissues. Osteitis fibrosa cystica does not manifest itself by any change in periosteum as a rule and never reveals more than slight thickening the structural change being confined within the cortex of the shaft. The lesion is more often metaphyseal and is never epiphyseal.

Between osteitis fibrosa cystica and giant cell sarcoma the difference can as easily be shown by the X ray as with the microscope. Some points of diagnostic importance in this particular are the longitudinal extent of enlargement of the shaft is more limited in giant cell sarcoma and the distention is greater. In giant cell sarcoma there is usually no bowing of the shaft in osteitis fibrosa cystica bowing is common. The cystic pockets in osteitis fibrosa cystica are separated by trabeculae of compact bone and are clean cut differing in this respect from sarcoma. The surrounding tissue is not involved in osteitis fibrosa cystica.

The onset and length of the history and the frequency of occurrence are a valuable help in differentiating osteitis fibrosa cystica and giant cell sarcoma. Osteitis fibrosa cystica is

the most common non malignant lesion of bone (26). Its onset is usually in childhood while in giant cell sarcoma the onset is usually after 30 years of age. A few cases have been reported with an earlier history yet there are still fewer cases of osteitis fibrosa cystica with a history of onset after 20 years. Pain may not be severe in giant cell sarcoma but is usually present and swelling generally occurs sometime after the appearance of pain in osteitis fibrosa cystica pain is not a conspicuous feature unless there has been a fracture. Pathological fracture is common in osteitis fibrosa cystica less so in giant cell sarcoma. The more malignant central sarcoma is at once recognized by its late history its destruction of the cortex involvement of the periosteum and surrounding tissue and the parchment crackle elicited on palpation of the tumor. Expansion of the shaft as shown by X ray examination of the benign giant cell sarcoma is missing in the malignant type (16).

Next to the roentgenologic picture in point of diagnostic importance stands the clinical picture of osteitis fibrosa cystica which in most cases is uniform and of long duration. The onset is in early life. There is usually history of trauma swelling and perhaps deformity. Pain if present is rarely severe at any time and disability is not noted unless there is a fracture. Pathological fracture is common frequently recurrent and is the turn of affairs that usually leads to discovery of the disease.

#### TREATMENT

In the treatment of osteitis fibrosa cystica the greatest economy of time is served by conservative surgery at the time the lesion is discovered. If the patient is confined to bed many months some of these lesions heal spontaneously as was suggested by Bloodgood (7) recently. The uniform success obtained by surgery with a comparatively short convalescent period however argues against the justice of so liberal a disposition of the patient's time by the attending surgeon even if the indications for this watchful waiting treatment are present. If the cystic area is small it is sufficient to expose the tumor break through the thin canopy and thoroughly clean out all soft tissue with a curette. Follow

ing this procedure the tumor stops its growth just as do benign cysts of other tissue when their contents are evacuated and the cystic capsule is removed. The cortical canopy should be crushed in and if bone chips are introduced into the cavity healing is probably hastened as in Case 6 herein reported. These chips are easily obtained with a trephine from the surrounding normal bone. Beck's paste is contra indicated in these cases as it forms an unabsorbable irritant. The Moorhof bone plug is also of little use in such cases; moreover the difficulties attending its application argue against its employment. If proper precautions are taken to prevent infection the average lesion will heal by primary union. The time for new bone to fill the cavity compactly is not great—one to three and one half months depending on the extent of the lesion. If the lesion is unusually extensive and there is a desire to correct or prevent deformity much aid may be necessary to insure a useful member. To accomplish this it is frequently necessary to introduce an implant from the tibia as was done in our Cases 1, 2 and 3. It is important to take this implant from the tibia of the unaffected leg when the lesion is in the lower extremity as a Buck's extension necessary to prevent the displacement or destruction of the implant by muscular contraction must not be applied over the skin wounds. Except in cases of extensive involvement or deformity efforts at plastic surgery are not indicated. In Case 4 no other operative procedure was employed than removal of the tumor *in toto*; a cast was applied as a precaution since the patient was going from under our care. A criticism against curetting these lesions is made by DeCourcy on account of the difficulty in ruling out sarcoma. Sarcoma with a history of as long duration as that presented in cases of osteitis fibrosa cystica would have a rather typical picture.

#### REPORT OF CASES

Cases 1, 2 and 3 are presented because of their characteristic clinical histories of bone cyst and because of the excellent surgical results obtained.

CASE 1 No 4594 F P a schoolboy age 14 years came to the Jackson Clinic September 21

1916 on account of pain and disability in the right hip following a fall the previous day. There was some swelling in the right thigh pain on manipulation and crepitation could be felt. There was an elevation of temperature.

A ray examination revealed a pathological fracture immediately below the trochanters also a central fibrocystic degeneration of the upper third characteristic of osteitis fibrosa cystica (Fig 1). Other laboratory examinations were negative.

It is important to note that in 1914 the patient noticed slight pain in his hip on walking. At that time also there was some elevation of temperature but there was no history of trauma and the general health was good.

The patient was operated on September 22 1916. A lateral incision beginning immediately below the greater trochanter and extending downward 24 centimeters exposed a normal periosteum. This was incised and easily stripped from the cortex which was grayish white and quite brittle. Scratching with a curette did not give the sensation of normal bone. The lateral aspect of the canopy was removed above and below the fracture which was immediately below the proximal limits of the fibrocystic change. The contents of the numerous cystic areas was scanty (there was some evidence of hemorrhage at the site of fracture) and of a thick fluid consistency rather reddish yellow in color. There was abundant evidence of a fibrous membrane in the vacuolated upper third which led the surgeon to confirm the opinion of the roentgenologist that this was a case of osteitis fibrosa cystica. After the cavity had been thoroughly cleaned with the curette an inlay graft 18 centimeters long was placed in a lateral groove uniting the upper and lower fragments. A cast with extension to prevent destruction of the inlay by muscular contraction was applied and kept on for 4 weeks. Dressings were applied through a window in the cast for 2 weeks until the wound had healed by first intention. The cast was changed twice being discontinued at the end of the ninth week when union appeared to be good. The recovery was complete.

An X ray examination in 1924 8 years after operation revealed a femur the bone structure of which varies not at all from the normal (Fig 2). There exists only a slight coxa valga to suggest that the femur has ever been other than normal.

CASE 2 No 4600 R M a schoolboy age 15 came to the Clinic September 23 1916 complaining of disability of the right arm. On the previous day while playing baseball he was in the act of making a long throw when he heard something snap after which he was unable to raise his right arm or put it behind his back. There was some swelling and pain and on manipulation crepitation could be felt in the upper third of the right humerus.

Clinically a diagnosis of pathological fracture was made. X ray examination warranted a conclusive diagnosis of osteitis fibrosa cystica (Fig 3).

The boy was admitted to the hospital the following day. The lateral aspect of the arm was laid open.



Fig 1 (l ft) C e Osteit fib sa cystic of pp  
th d of femur bef e per t on

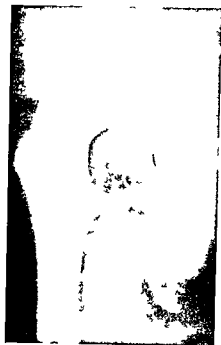


Fig 2 Ca r R entgen g m tak 8 yea s  
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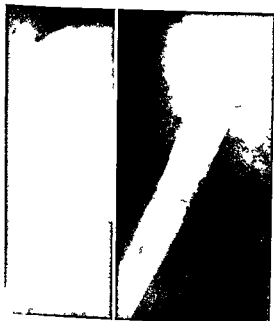


Fig 3 (l ft) C e Osteit fib sa ytc of pp  
th d of hum ru bef e operati



Fig 4 Case P ti t 7 ye rs fte per t on

Fi 5 (l ft) Case 3 O t it fib osa cyst ca f ppe  
th d of h merus bef e op r tu n

Fig 6 Cas 3 Patie t 4 ye rs ftr surgical p i



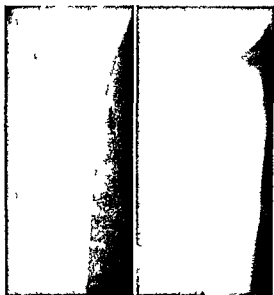


Fig. 1 (ft) Case 4. Localized osteitis fibrosa cystica of medial aspect of proximal end of tibia.

Fig. 8 Case 4. Lateral view of plaster cast in Figure 7.

the incision revealing a gravely vitiated cortex which crushed easily. The contents of the cystic area was gelatinous and at the site of the fracture considerably blood streaked due to hemorrhage. The contents were removed with a curette. A definite fibrous membrane lined the numerous cystic spaces. A long bone graft from the fibula was laid into the groove uniting the fragments of the humerus. A cast in which a window was cut for dressing was applied to the arm and chest. Extension was applied by weights and pulleys to counteract muscular contraction. At the end of 2 weeks the incision was healed. Six weeks later callus was laid down along the entire transplant but a new cast was applied for an additional 4 weeks. At the end of 6 months from the time of operation good function was restored in the member.

In 1923 7 years after operation the X-ray examination showed a humerus with slight deformity as to shape otherwise normal (Fig. 4).

CASE 3 No. 33296 Miss E. K. age 12 was brought to the Jackson Clinic October 2, 1919. The chief complaint was partial paralysis of the right arm following an injury 4 days previously. The history dated from 1911 when the patient was 9 years old. She had fallen and injured the right shoulder after which she had been unable to raise her arm or her head or put it behind her back for a few days. During the 2 years preceding her first visit to the Clinic she had fallen at play four or five times injuring the right shoulder. After each of these injuries she had suffered a partial paralysis of the arm.

On examination the right shoulder was noted to be swollen, tender and painful on manipulation. Crepitation could be felt at the upper third of the humerus. A clinical diagnosis was made of bone cyst with recurrent fracture. X-ray examination confirmed the clinical findings and led to a diagnosis of osteitis fibrosa cystica of the upper third of the right humerus (Fig. 5).

The patient entered the hospital October 23, 1919. The following day the arm was opened with a lateral incision at the upper third. The cystic area was curetted and an Albee inlay graft from the tibia was inserted. The patient apparently recovered and was discharged from the hospital after 5 weeks.

An X-ray examination 4 years after surgical repair showed a practically normal humerus (Fig. 6). Clinical inspection revealed no deformity and there was no limitation of function.

CASE 4 No. 30635 The principal interest in this case is the occurrence of early osteitis fibrosa cystica with chronic osteomyelitis in a different and remote member.

Miss M. P. age 16 came to the Jackson Clinic May 7, 1921. She had had pneumonia at 3 years of age and rheumatic fever at 15. Her chief complaint was chronic pain, swelling and disability of the left foot of 14 years duration. The foot had been lanced when she was 6, 11 and 14 years old. A large amount of pus had been removed each time after which procedure the member had apparently healed but each time had become swollen and painful again in about 6 months.

Besides a low grade inflammatory condition of the left foot physical examination revealed a slight asymmetry on the lateral aspect of the right leg immediately below the knee. On palpation this area appeared to be a hard, smooth tumor attached to the tibia. The tumor was slightly tender to deep pressure and had recently given slight pain. There was no superficial evidence of an inflammatory condition at this site and no history of injury.

The X-ray examination revealed besides an osteomyelitis confined to the bones of the foot a rarefied area in the head of the right tibia resembling a trabeculated cyst (Figs. 7 and 8). Three centimeters below the cyst was a small sequestrum and a small sinus which did not appear to communicate with the cyst. Diagnosis was made of osteitis fibrosa cystica in the head of the right tibia complicating an old osteomyelitis of the left foot.

Laboratory examinations at this time showed a trace of albumin in the urine, hemoglobin 75 percent, leukocytes 17,600 and negative Wassermann reaction on the blood.

The patient entered the hospital May 16, 1921. Necrotic foci of osteomyelitis were removed from the left foot. Also surgical attention was given to the cystic area in the tibia. A semicircular flap was turned from the wall of the upper end of the right tibia exposing a vitiated cortex. A small sequestrum which lay at the lower end of the incision was removed. The bone canopy of the cyst



Fig 9 (left) Case 5 Lateral view of the face of the patient. A large, well-defined, rounded swelling is noted on the right side of the face.



Fig 10 Case 5 Anterior view of the face of the patient. A large, well-defined, rounded swelling is noted on the right side of the face.

was punctured the soft material removed and the cavity thoroughly curetted. The margins of the cavity were then flattened to meet the soft parts and closure was made with plain gut without drainage. Concerning the findings at this site the notes on the surgical record read: The cyst is trabeculated and lined with a membrane. It does not resemble osteomyelitis. There is no apparent tendency toward bone proliferation and no definite necrosis but the effect is rather the appearance of a rarefying osteitis.

The curettings from the cyst were submitted to Dr. Bunting of the Pathological Department of the University of Wisconsin Medical School and he reported:

The bone in general shows rarefaction though an occasional trabecula appears thickened. The marrow between the trabeculae is in general fatty and contains large thin-walled vessels from which there has been old and recent hemorrhage (the former shown by blood pigment in the phagocytic cells). There are some larger hemorrhages in process of organization. The wall proper of the cyst consists of a fibromyxomatous tissue which does not suggest a neoplasm but rather an atypical inflammatory tissue or a tissue resulting from organization. There are practically no indications of an inflammatory process as such in the specimen and one gains the impression that hemorrhage might have been the primary lesion. This is difficult to establish because there have been later hemorrhages into the newly formed tissue. The lesion then may have been primarily inflammatory leading to injury to the vascular endothelium and hemorrhages and the organization of these led to covering up the early process.

A plaster cast was fitted to the right leg and thigh and hot boric acid packs were applied to the left foot. After a week of this treatment the patient was allowed to return home with instructions to have the cast removed in 3 weeks. At the time of discharge the infection in the foot was markedly improved.

At our request this patient returned for observation March 9, 1924. She has had an occasional flare up of osteomyelitis in the left foot but is in good health in all other respects. A ray examination made at this time showed a satisfactory healing of the cyst in the tibia.

CASE 5 No. 33215. Osteitis fibrosa cystica does not commonly occur in the flat bones. The principal interest in this case lies in the location of the cystic process and in the excellent results obtained from surgical treatment.

Mr. J. G., age 25 years, came to the Jackson Clinic November 17, 1922, on account of a marked deformity on the right side of the face. This gave him a peculiarly ludicrous appearance to his great discomfort. The history dated from a fall when he was 3 years of age. An enormous growth had appeared soon afterward on his right cheek and had not changed in size since that time. No interference with breathing had been noted.

Slight pressure produced some pain. When the nose and mouth were examined slight bulging of the lateral wall of the right nasal chamber was observed with a marked intra-oral bulging of the right side of the hard palate. The right upper molars were widely separated by pressure from the growth. The right antrum was opaque to transillumination.

The report of an X-ray examination (Figs. 9 and 10) made at this time reads:

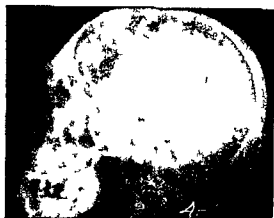


Fig 11 Case 1 Lateral view after removal of the facial tumor

This case is characterized by the existence of three areas of irregularly rarefied bone confined to the right side of the face and skull. The area of greatest absorption is in the facial bones and is surrounded by a ring like periphery of sclerosed bone. All areas of absorption however are in a greater or lesser degree subdivided into vacuoles. In addition to the cystic appearance there is much increase in density of adjacent bony structures. Here and there especially in the facial bones the fibrous density is accompanied by cystic degeneration and the two processes exist apparently in equal degree. After the exclusion of lucas giant-celled sarcoma and Paget's the diagnosis becomes probably one of osteitis fibrosa cystica (von Recklinghausen's disease).

Examinations of the blood and urine were negative.

The patient entered the hospital November 10, 1922. Since the desire of the patient was for the correction of his facial deformity no measures were taken against the cystic areas in the bones of the skull. An incision was made immediately below the outer canthus of the right eye extending medially to the border of the nose and then downward following the upper lip. Skin and muscles were reflected en masse. A bony cystic area 3 by 8 centimeters involving the upper right side of the face was chiseled away and the normal contour of the face was established. Closure was made with drainage. The postoperative examination of the tissue removed confirmed the diagnosis of osteitis fibrosa cystica.

Except for a scar at the site of the incision there is but slight evidence of the former deformity. The cosmetic result in this case has justified the measure taken.

CASE 6 No 38148 Miss R. S. age 8 years came to the Jackson Clinic November 14, 1923. Her chief complaint was a lump and pain in the right hip when she walked. The patient's condition had first come



Fig 2 (left) Case 6 Localized osteitis fibrosa cystica in the proximal end of the right femur before operation. Fig 3 Case 6 Osteitis fibrosa cystica after curettage and implantation of bone in the hip.

to the attention of the mother in the latter part of 1922 when a slight lump had been noted on the right side. This had gradually become worse and the child had complained of some pain on walking. No history of loss of weight, night cries, cough, elevation of temperature or trauma could be elicited. The patient's general health has remained good.

On the basis of an X-ray examination made elsewhere October 14, 1923, a diagnosis of tuberculosis had been made and a plaster cast had been applied at that time. The cast was removed November 3 when another X-ray examination was made by the same doctor. The lesion had again been called tuberculosis of the femur and an operation had been advised.

A physical examination made in this Clinic November 14, disclosed no other information than slight pain on manipulation of the right hip. X-ray examination revealed a polycystic condition between the trochanters of the right femur which had the characteristics of a local lesion of osteitis fibrosa cystica.

The patient was admitted to the hospital the following day. An incision was made over the outer aspect of the greater trochanter and carried downward 15 centimeters. With a trephine the wall of the cyst was penetrated and the contents curetted. The orbital canopy was then crushed in and the remaining cavity filled with bone chips obtained with a trephine from the femur 5 centimeters below the cavity. The periosteum was closed separately then the soft part without drainage. A cast applied to the right hip and pelvis was left on for 4 weeks. The surgeon reported the cyst to have had a membranous lining with other characteristics of cystic osteitis fibrosa.

The patient has been kept under observation the last X ray examination October 10 1924 showed a satisfactory course

## SUMMARY

1 Osteitis fibrosa cystica is a distinct benign central bone disease the history of which has been developed since 1891

2 The etiology is not definitely known but trauma appears to be a common factor at the time of diagnosis

3 The pathogenesis appears to be that of metaplasia and early malacia

4 Diagnosis is made by the X ray examination as first aid supported by a long history with onset in early life and if there is no fracture little or no loss of function Differential diagnosis is to be made between osteitis fibrosa cystica and other common central bone lesions Microscopic examination of tissue removed is essentially important in making a prognosis if the signs of benignity or malignancy are definite otherwise the postoperative clinical course is the only dependable basis on which to form conclusions

5 The treatment is distinctly surgical at the time the lesion is recognized

6 A review of the cases herewith presented supports the conclusions above enumerated

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## SYSTEMIC BLASTOMYCOSIS

By CHARLES C GARR MD FACS L VINGTON KE TL KY  
Le g Cl

**T**HE blastomycete has been known since 1894 when both Gilchrist (2) and Busse (1) described it. Since then many cases have been reported of local blastomycosis but few of the systemic type. A. M. Stober (3) has made the most comprehensive study of the subject and review of the literature of which I know and reports one cure. A letter from him advised me that there has been no material advance in the treatment.

The following case referred to an orthopedic surgeon by a general practitioner beginning with symptoms of any thing but grave import passing through a long and painful course and ending in death is reported because of the rarity and increasing frequency and because it is one of the less than 50 reported cases of systemic blastomycosis.

Mr W. T. age 45 came to see me on July 21, 1923 complaining of a rheumatic like pain in the metacarpophalangeal joint of the left index finger. Two weeks previously this pain began followed by redness and swelling over the joint and over the dorsum of the hand. About July 1, 1923 he had a nervous breakdown. He became anæmic and lost 14 pounds in weight. Pain, a dull and boring character in the finger had gradually gotten worse so that he could not sleep at night. He had no other complaints except this finger and general weakness and loss of his accustomed vigor.

The mother and father and one sister are living and in good health. Two brothers died in infancy—cause unknown.

Patient had measles, mumps, whooping cough and chicken pox when a child, inflammatory rheumatism 17 years ago, influenza in 1918 and in 1919 a middle ear infection which was very obstinate and could not yield to local treatment but improved and finally healed under iodide of potassium. (This was reported to me by Dr. J. A. Stucky, the otologist who treated him.) To my mind this has a distinct bearing on the onset of the disease.

There was no history of any venereal trouble. He was married and his wife and two children had always been well. For 25 years he was a distiller of whiskey coming in contact at all times with yeast fungus and since the Prohibition Act he had handled tobacco which often has a mold on it. He has never lived in a damp or mouldy house.

**Physical examination.** His height was 5 feet 9 inches, weight 136 pounds. He was anæmic in ap-

pearance with temperature 99, pulse 80, respiration 18. Head, neck, chest and abdomen were negative. The metacarpophalangeal joint (left) was swollen, red and very tender to pressure, the motion of the finger causing pain. There was no fluctuation. No other joint was involved. There was slight tenderness over the epitrochlear glands but no axillary gland enlargement or tenderness. On the left side of the face was a pustule characteristic of a small infected sebaceous cyst.

The Wassermann test and urinalysis were negative. The white cell count was 9000 with 72 per cent polymorphonuclear.

My first impression was that this was an arthritis as in his past history he had a polyarticular arthritis. In the following few days a focus of infection was sought in teeth, tonsils and prostate but these examinations were pathologically negative. The pain in the finger became worse and fluctuation became evident. Aspiration a few days later gave a thick purulent fluid which produced no growth when cultured for 48 hours.

The x-ray examination of the finger showed destruction of the second metacarpal bone (Fig. 1).

Salicylates and barking were given up to the time operation was decided upon.

On August 22, 1923, an incision was made over the second metacarpal bone. The bone was free from its periosteum and was lifted out without a violent effort. The site was bathed in purulent fluid with caseous appearing material in it. At this time I thought this evidently a tuberculous infection. Culture from this however produced a growth of blastomycetes at room temperature but those in the incubator did not grow with such rapidity. (See report of pathologist and Figs. 2 and 3.) The infection on his cheek which had been opened by himself and was still discharging was then cultured with the same laboratory findings. August 24, 1923, the hand was much better. There was a small amount of discharge.

He had no night sweats for the past 3 nights. Aspiration relieved the pain. August 26, the left epitrochlear gland was swollen and red. He could not move it without pain. For the past week he had had pain in the first phalanx of the right great toe.

August 30, under general anesthesia the great toe was incised, the first phalanx removed and the periosteum found filled with thick purulent material. Iodoform packing was used and the left epitrochlear gland drained. (Cultures from each showed blastomycetes. Fig. 4.)

September 1, his complaint of pain in the right knee. The patella was very sensitive to pressure.



Fig. 1 (lt) Blast mycotic destruction of left metacarpal bone

Fig. 2 Photomicrograph of a paraffin section stained with hematoxylin and eosin



Fig. 3 (left) Photomicrograph of section from clavicle showing necrosis

Fig. 4 Blastomycosis involving the face

From September to December there was a gradual loss of strength increasing anemia and progressive bone destruction—the left clavicle the sternum the right metacarpal the parietal and occipital bones all having small abscess formation. There was some improvement in the patella but the pain was never relieved. The inferior maxilla was involved which markedly interfered with mastication and deglutition. Skin manifestations appeared one after another but never healed. These were small areas 1 to 2 centimeters in diameter over the face scalp and lower extremities. The chest was examined repeatedly by an internist but always with negative results. There was no cough and scarcely enough sputum to use in laboratory investigations. No blastomycetes however were found in the sputum.

October 5 under gas anesthesia an incision was made to relieve pressure over the clavicle behind the right ear and over the sternum. Positive blastomycetic cultures from each abscess were obtained.

There was a gradual increase in the weakness anemia and number of lesions and complete loss of appetite. It was necessary for him to be kept under opiates at all times on account of pain.

December 24 he became comatose and died December 27.

No post mortem examination not even a post mortem X-ray was permitted. Repeated examinations of the urine showed only a trace of albumin. An unsuccessful effort was made to culture the organism from the urine. Blood examinations showed gradual decrease in the hemoglobin and red blood cell. On October 14 the hemoglobin was 30 per cent erythrocytes 3,68,000 leucocytes 8,400 small lymphocytes 15 per cent polymorphonuclears 85 per cent. Positive blood culture was never obtained though repeatedly tried. The temperature was normal to 100.5 each day with an occasional rise to 101.

#### TREATMENT

Potassium iodide was given in ascending doses per os but nausea and vomiting contraindicated more than 30 grains per day. Sodium iodide (30 grains) was given intravenously 5 times causing chill and fever each time. Neoarsenobenzol (grams 75) was given intravenously 3 times with no apparent improvement.

**Local treatment.** One per cent copper sulphate solution iodoform gauze 1 per cent acriflavine solution and 2 per cent mercurochrome were successively tried. A riflavine seemed to keep the wound in a more healthy condition than anything else. Bouillon filtrate of blastomycetes with increasing doses was tried subcutaneously but no local or general improvement was noted. A slight local reaction was noted when the larger doses (1 cubic centimeter) were given.

X-ray treatment was tried over the open lesions with apparently no change.

Ordinary diet was given with the addition of gelatinized milk but it was difficult to keep an appetite with the amount of potassium iodide and morphine he was taking.

The laboratory report is the work of Dr. E. S. Maxwell.

**Summary of laboratory findings.** The first material submitted to the laboratory was pus aspirated from a lesion over the metacarpal bone of the left hand. No bacteria were demonstrated in spreads stained by Gram's method or for acid fast organisms. Cultures produced no apparent growth at 37 degrees C. at the end of 3 days. At this time the cultures were placed at room temperature and through an overnight were not again observed until the end of 4 days. At this time all inoculated media (nutrient agar blood agar Loeffler's blood serum and glucose bouillon) presented colonies. On the solid media the colonies were discrete dry light brown in

color and measured about 1 millimeter in diameter. Microscopic examination showed spherical cells with highly refractile cell walls and slightly granular protoplasm. Many cells were budding. The bouillon media presented round cotton like tufts that measured about 3 millimeters in diameter. The spores of the organisms isolated were about 20 microns in diameter.

At this time material from the toe and elbow were available for study and macerated in potassium hydroxide solution presented typical highly refractile budding spores.

Microscopic examination of sections of tissue from the hand showed a marked inflammatory reaction with necrosis and foreign body giant cells. A mistaken diagnosis of tuberculous inflammation was first made. After the nature of the lesion was recognized from the cultures a restudy of this tissue with oil immersion objective showed many budding spores similar to that described above. Later blastomyces were demonstrated in tissue from clavicle skull and

other lesions. In the older lesions many very small spores were noted.

Repeated blood cultures with large quantities of blood and large quantities of media were negative. Blastomyces were never demonstrated in urine or sputum. The organisms grew readily on all ordinary culture media. On the primary cultures a radiating mat of mycelia surrounded each colony at the end of the third week. In a few days aerial hypha appeared and in time filled the culture tube. In the second and third transplants the mycelia appeared earlier and after the third transplant colonies of spores did not appear. Subcultures grew readily from cultures that have been at room temperature for 12 months although the aerial hypha are not pronounced in the recent plants.

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# DEPARTMENT OF TECHNIQUE

## COMBINED SATCHEL HANDLE OR TUBED PEDICLE AND LARGE DELAYED WHOLE SKIN PEDICLE FLAPS IN A CASE OF PLASTIC SURGERY OF FACE NECK AND CHEST

BY B I MIDL MD FACS SAN FRANCISCO CALIFORNIA

THE object of this paper is to present a case of severe second and third degree burns with resulting cicatrization and contracture of tissues of face neck and thorax and to describe a series of operations to correct the defect and the end result after 3 years following the extensive and complicated adaptation of the satchel handle and delayed pedicle graft method which was used and described during the World War by Gillies and Blair and later by G B New of the Mayo Clinic C C Coleman and probably others

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Figs 3 and 4 Photograph showing tent flap sutured to the skin as bro h t h s p t l  
 Figs 5 and 6 Photographs taken after the first operation  
 Figs 7 and 8 Photographs taken after the second operation  
 Figs 9 and 10 Photographs taken after the third operation  
 Figs 11 and 12 Photographs taken after the fourth operation

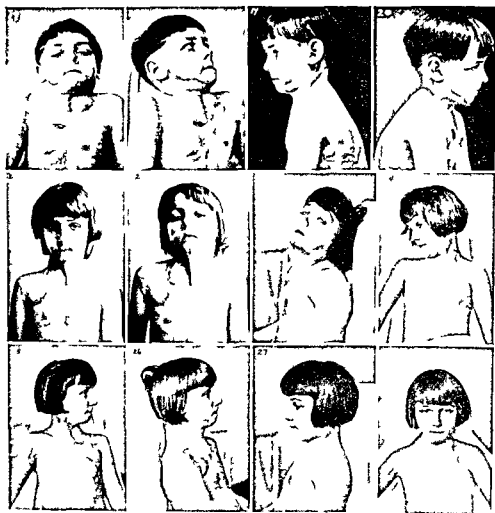


Fig 7 a d 18 Cond t n eeks ft r fifth prati n  
 Fig 9 and o C dt lter ft haling fifth prati n  
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Fig. 23a. Z-plast of lateral scars to overcome contracture. Stains from mercuric iodine dressings.

Fig. 3b (right). Final open Z-plast of lateral scars. Showing result of previous Z-plast of medial contracture scar.

The delayed flap assumes preknowledge of viability of graft before the perforating incision is made. The grafts become attached at first fixed and while they are flexible and easily adapted to a dry surface they shrink much less than do recently dissected flaps. The presence

of newly formed granulations and capillary blood vessels in the under surface of delayed flaps assure a more rapid union with the freshly denuded surface upon which they are engrafted.

In this case we were especially fortunate in that no mucous surface presented to be covered nor was prosthetic appliance necessary to establish plastic contour.

To mention a few drawbacks met with in cosmetic and plastic surgery of this nature by far the most important to the surgeon is the tendency to exuberant cicatrization or keloid formation along or adjacent to the suture line when subjected to undue tension. Pulling on the scar from whatever cause must necessarily be prevented or contracture and deformity will surely result. The method of approximation of subcutaneous edges by eversion as described in 1923 by Dorance and Bransfield is a long stride in the right direction for the prevention of exuberant scar formation. Overgrowth of hair on surface of grafts as well as the slight difference in texture and color are minor objections to the surgeon but loom large in the mind of the female patient and therefore demand due consideration to the end that such defects may be overcome.

## THREE-STAGE OPERATION FOR RADICAL RESECTION OF THE COLON FOR CANCER

WITH REPORT OF A CASE

By JAMES G. MONTGOMERY, M.D., F.A.C.S., KANSAS CITY, MISSOURI

THE following case is reported for the reason that it presents four very interesting features: first, a differential diagnosis of tumors of the colon because the filling defects are characteristic of an intraluminal growth; second, the unusual occurrence of an intussusception of the carcinomatous cæcum and ascending colon into the transverse colon; third, the preparation of an apparently inoperable case to withstand a surgical operation; and fourth, the radical resection of the colon under local anesthesia with excellent results.

Mrs. M., age 73 years, began to give marked symptoms in May 1919, characterized by loss of weight and constipation alternating with pain in the abdomen as if she had taken a severe cathartic, followed by diarrhoea and passage of blood and mucus. An palpable mass was first observed in October, 1919. It seemed to vary in size with passage of gas and diarrhoea. Her normal weight was 130 pounds, but in October, 1919, she weighed only 79 pounds. She ate very little and was annoyed by more or less constant pain in the abdomen.

**Physical examination.** The patient is anemic, manifested by weak walk, with difficulty and inability to bed most of the time. Her general physical condition is without interest except for the suggestion of malignancy. The abdomen presents a transverse fullness, the umbilicus that is sausage shaped and measures by 3 1/2 inch single transverse diameter. It is hard, distended, and is at the distal end of soft and doughy proximally. It has a wide range of mobility especially in the right abdomen. Intestinal patterns are present and there is hyperperistalsis, a general tympany. The blood count shows: haemoglobin 35 per cent, red blood cells 2,320,000, and white blood cells 9,000.

**Diagnosis.** The presence of blood in mucus in the stool with tenderness, crested peristalsis, and tympany indicate a tumor of the large gut. The presence of the tumor above the umbilicus suggests that it is located in the transverse colon. The supposition is confirmed by the mobility of the mass and by the termination of the bismuth enema at the distal extremity of the tumor mass (Fig. 1). The hard distal extremity in all probability is the tumor mass itself, while the softer more compressible proximal portion is a fecal mass retained by the tumor.

**Treatment.** The presence of megacolon obstructs not only indicates the operative removal of the mass, but also my her general condition. She has a history that the likelihood of her surviving a operative small operation, the closer she is brought to the point where operation will not be unduly hazardous.

**Po-operative treatment.** She was given a high loric diet for 24 hours from 7 a. m. to 3 p. m. The diet consisted mainly of milk, cream, egg nog, egg album, creamed custards, egg malted milk, etc. Two days preceding the operation water was forced by mouth, she was given 1/2

dram of soda in 1/2 glass of water every 2 hours from 7 a. m. to 9 p. m. and was also required to eat as much as possible of a poultice of glucose stick candy. Her irritable bowel prevented the use of a 4 to 48 hour post-operative proctoclysis of glucose and soda. Her assumption was so poor that anoxia so extreme in spite of the forced feeding that she made no gain. Transfusion was then resorted to and her blood content indicated the rate of improvement.

October 7, 1920. Haemoglobin was 35 per cent, red blood cells 2,300,000 and white blood cells 9,000.

October 8, 1920. She received 600 cubic centimeters of blood by the Lindman method.



Fig. 1. The filling defect produced around the alacarcinal adenoma tumor mass in the transverse colon by giving a bismuth enema.



Fig. 3. The ileocecal  
 diverticulum  
 growth in the transverse colon  
 also the area of intussusception

Fig. 3. The ileocecal  
 diverticulum  
 growth in the transverse colon  
 also the area of intussusception

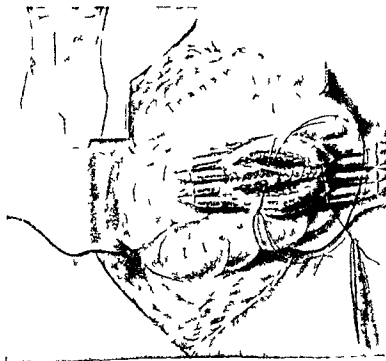


Fig 4 The mass retained by a rubber band through the so in the colon anorectum the ileum and the mass in the enterotomy. The section shows wound loss of a u d the tumor



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Fig 5. The amputation of the tumor mass. The insert shows the sutured stump in final closure.

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l o c o l n e a n t o m s f n e t n g p r o p e l y I t s t h n  
th g b t d v i b l t c l th f i s t l a e

*Technique of the third state of the operation*  
Morphine 4 grain and atropine 1/150 grain  
were given hypodermically and followed by ga  
oxygen

The skin was incised around the wound and  
the fistula approached from all sides as in a

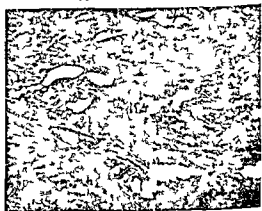


Fig 6. Photomicrograph of the tumor showing the ductal type carcinoma.

ventral hernia the fistulæ and infected field being isolated by hæmostats on the skin margin. Laparotomy tapes were used to protect the outer skin margin. The two fistulæ were close enough together so that the final stump was clamped in a hæmostat as an appendicular stump cut off carbolized, ligated and inverted with a double chromic gut purse string. The marginal wound adhesions were liberated and the usual closure was made with catgut in the peritoneum, chromic No. 2 in the fascia, silk worm retention sutures and the skin with silk. A strip rubber dam drain was inserted in the lower angle of the wound and after this was done a moist hot dressing was applied.

August 9, 1921, 7 days after the third stage of the operation she had some serous drainage which grew bacillus coli on culture.

August 18, 1921, she went home in good condition with wound closed.

January 9, 1922, 1 year and 4 months after the operation the patient reports that she feels quite well and is doing her own house work.

*Pathological report.* The specimen is composed of the cæcum in which the growth is located 4 inches from the ileum, the ascending colon and 6 inches of the transverse colon and adherent omentum weighing 500 grams. The growth involves most of the cæcum and all but  $\frac{1}{4}$  inch of the tip of the appendix. The cæcum is inverted and lies in the proximal portion of the transverse colon. The ascending colon (Fig. 2) is hausted like an accordion below by the extension of the growth in the direction of the fecal stream. The neoplasm measures 3 by 3 inches in greatest dimensions and is firm, irregular, looks like a cauliflower and has a stenosed ragged ileocecal opening through which the fecal stream emptied into the transverse colon. The portion of the transverse colon forming the bed of the growth is thickened, the serous surface is injected and the omentum adherent. The terminal portion of the ileum is not involved by the growth.

Microscopic section shows a dense medullary type carcinoma (Fig. 6).

The pathologic diagnosis was carcinoma of the cæcum with involvement of the cæcum and ascending colon into the transverse colon.



## CÆSAREAN SECTION AFTER THE TEST OF LABOR

## DESCRIPTION OF AUTHOR'S TECHNIQUE

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**T**HE method of performing cæsarean section depend upon the stage of labor and the complications present in the individual case.

When the operation can be performed before labor begins and the woman is free from infection a short high incision with the uterus opened in the abdomen and hooked out with the forefinger will probably remain the operation of choice with the majority of surgeons. This operation has been termed the classical cæsarean section but it offers two distinct disadvantages in contaminated cases.

1. The spill enters the peritoneal cavity at the time the operation is performed.

2. The infected lochia may seep into the uterus wound and into the general peritoneal cavity after the operation has been performed.

The mortality rate should be very low with the classical operation under ideal conditions but ideal conditions are often absent and the mortality rate is not as low as we are led to believe in a study of statistics from some of the well organized clinics throughout the country.

E. Holland (5) reported 3,374 cæsarean sections performed throughout Great Britain from the years 1911 to 1920 in which the average mortality was 4 per cent with a mortality of only 1.6 per cent in the early uncontaminated cases but 27 per cent in the late cases or in those in which delivery had been attempted. E. L. King (7) reported 117 abdominal cæsarean sections at the Charity Hospital of New Orleans (excluding the Porro cases) in which there were 12 deaths from peritonitis and 2 from sepsis; all these patients had vaginal examinations or attempts at delivery before operation. Most of the 76 patients recovering had fever the puerperium being absolutely afebrile in only 17.

In studying the cause of death infection stands out as the predominating factor. The area of invasion occurs in exactly one place, the vagina and while it is well known that the infection is in direct proportion to the length of time a woman has been in labor, rupture of the membranes, the number of vaginal examinations and the attempts at delivery, either manual or instrumental, there still remain many women who are sent into the hospital for cæsarean section after these principles have been violated.

If it is true that most puerperal uteri contain pathogenic organisms by the fifth or sixth day the logical deduction would be that the suture line offers the most favorable area for invasion of the peritoneal cavity. Polak (9) gives the incidence of pathogenic organisms in the uterus as 28.8 per cent in uncontaminated cases and 50 per cent in cases in which the patient has been previously examined.

## TYPES OF OPERATION PERFORMED IN CONTAMINATED CASES

In order to avoid the unjustified risk to the mother which is inevitable when the classical section is used in contaminated cases several other forms of abdominal delivery have been introduced. The extraperitoneal methods which have for their object the avoidance of opening the peritoneal cavity were largely developed in Europe because so many women are referred to the continental clinics by midwives after many examinations. Joerg as early as 1809 performed the extraperitoneal operation by gaining access through the flank. He was followed by Selheim who pushed the peritoneum from the bladder anteriorly and later by Latzko who preferred to separate the peritoneum upward off the lower uterine segment with the bladder forced to one side.

In 1908 Frank (4) of Cologne operated in contaminated cases by means of a transverse incision with enough separation of the peritoneum from the bladder and the anterior surface of the uterus for delivery of the child, the parietal peritoneum first having been united to the uterine peritoneum in order to shut off the peritoneal cavity. Doederlein approached the uterus through an incision parallel to Poupert's ligament. The true extraperitoneal operation has never been widely adopted in this country because of the technical difficulties encountered and the liability of injuring the bladder or ureter.

Kroenig (8) advanced the thought that the superior results in contaminated cases were not due to the fact that the operation was performed in an extraperitoneal manner but because the incision was made in the thin non-contractile lower portion of the uterus and hence the wound could heal in peace and not be subjected to the tugging

and pulling due to the contractions in the thick body of the uterus. This muscle grinding actually pulls apart the edges of the incision and allows infected blood to fill the gaps. The danger of rupture of the incision during after pains is so great that Holland in his studies came to the conclusion that the rupture incidence was two and a half times greater when catgut was used than when silk was used and that silkworm gut was the best of all. Many operators using catgut insist upon the interrupted stitch feeling that the continuous stitch when used alone does not adequately take care of the relaxation due to the unrest of the uterus. Many of the deaths ascribed to surgical shock are probably due to rupture of the uterine incision.

Kroenig devised an operation which opened the peritoneal cavity by a low longitudinal incision separated the bladder from the uterus made a longitudinal incision in the lower part of the uterus emptied the uterus sutured the uterine incision and covered the incision with bladder by suturing the bladder peritoneum above the upper aspect of the uterine incision.

Beck's (6) technique differs from the Kroenig operation in only one respect. An upper flap of peritoneum is raised after the bladder is separated. After the uterine incision is closed the upper flap is sutured down over the upper part of the incision and the lower flap is brought up over this in such a fashion that a double layer of peritoneum safeguard the uterine incision.

De Lee (2) has further modified the operation by uniting the fascia between the bladder and the uterus as a separate layer and using a suction apparatus to empty the uterus. J. C. Hirst and Van Dolsen adhere to the Beck technique with the modification of a gauze pack across the lower part of the abdominal cavity for protection against the infected spill.

#### DISADVANTAGES OF LOW OPERATION

The low operation as ordinarily performed is more difficult technically than the classical operation and requires a longer time.

The patient must be well advanced in labor but she generally is or the surgeon would hardly consider this type of operation. With the exception of the Hirst and Van Dolsen operation where gauze is used as a pack, no adequate protection has been given to the general peritoneal cavity against the infected spill although the operation adequately safeguard against infection spreading through the incision.

The opponents to the low operation have based their arguments upon the fact that during the

operation infected blood and liquor amni fluid their way into the peritoneal cavity with all the methods thus far devised.

Paddock, Heaney and Holmes believe that there is as much danger of the spill getting into the peritoneal cavity in the low operation as in the classical operation. Paddock substantiates his assertions by statistics and personal observations.

The opponents also quote Munro Kerr as saying 5 years ago that the one advantage of the Fritsch incision was that it was farthest removed from the potentially infected cervix.

#### METHODS DEvised FOR OVERCOMING DISADVANTAGES

Those who are enthusiastic over the advantages of the low operation quote Munro Kerr (6) as saying at a later period in his life that healing in the cervix is better than in the fundus because active involution and fatty degeneration of the uterine wall defeat the healing power of the tissues.

The method devised for protecting the peritoneal cavity during the operation are walling off with gauze attaching the visceral to the parietal peritoneum the suction pump and the method about to be described.

The operation in which gauze is used as a coffer dam has been well described by J. Hirst and Van Dolsen and their results have been excellent in an extended series of cases.

When the visceral and parietal peritoneum are sutured together the uterus often pulls away from the abdominal wall especially when a large child is encountered and the stitches or forceps are pulled out the purpose of the operation thus being defeated. Newell has stressed the fact that the suture line was not infection proof. My personal belief is that unfortunately one secures apposition of suture lines rather than an effective barrier against the spread of infection.

The suction pump does not remove all of the infected liquor amni and when the child is delivered a gush of infected fluid comes with it.

All the methods have given good results as in fact have the methods in which no precautions have been taken to protect the peritoneal cavity but all the important statistics on the results of the low operation have emanated from the large obstetrical clinics where refinement of individual skill and the adoption of ultramodern principles of surgery influence to a great degree the low mortality rate.

De Lee and Cornell (3) flatly state that the mortality rate of cesarean section is high because

the operations are performed by general surgeons in most instances. It is absolutely necessary therefore that any operation which is to be widely adopted should not only be one which the general surgeon may readily perform but one which will afford effectual protection of the peritoneal cavity at the time of operation by the less experienced man.

Before describing the operation which we have adopted to fulfill these requirements I wish to state that absolutely no claim to originality is made and the following technique is simply a detailed description of the various steps which I have found to be easy and safe when a general surgeon must attempt these operations.

#### TECHNIQUE

The lower uterine segment should be well distended since if this has not occurred the uterine incision can not be made without extending the cut into the body of the uterus. In other words the patient should have been in labor a few hours so that the cervix is some distance away from the bladder. A midline incision from the umbilicus or a little above to the symphysis pubis is made. The peritoneum is opened. The uterus is evulsed out of the incision and the abdominal wall closed with clamps or silk running sutures close up to the uterus so that it is forced down toward the symphysis. Several large flat sponges are then spread out over the abdominal wall under and to the sides of the uterus or if the incision has not been closed tightly rubber dam is used under the sponges. Two sponges are placed in the lower angle of the incision on each side.

It will be noted that up until this time the hands of the operator has not become infected by contact with the contents of the uterus and no harm can occur from introducing the sterile gloved hand into the peritoneal cavity. A transverse incision is made in the peritoneum of the uterus about a half inch above the junction of the uterus with the bladder. The bladder with the lower peritoneal flap is dissected below and is pushed down well toward the vagina. We next make a longitudinal incision in the center through the muscular layers of the uterus. It is probably better to start the incision from below so that blood will not obliterate the field.

The membranes are ruptured, the face is rotated anteriorly, and the head is delivered with forceps if it is impossible to deliver it with the hand. I usually am able to deliver it with the hand.

The hands and instruments are now infected for the first time with the infected contents of the uterus. The uterus is crowded down hard

against the symphysis pubis over which most of the drainage flows. Iodoform is injected into the arm not the body of the uterus. If the placenta does not separate spontaneously it is gently removed from the uterus care being taken to remove all the membranes. If the placenta is hurriedly separated hemorrhage is apt to occur. The uterine wound is then sewed up with No. 2 twenty-day catgut interrupted sutures being used for the first layer, the uterine muscle being embraced down to but not through the endometrium.

The second layer is a continuous No. 2 twenty-day catgut suture which catches the uterine muscle. In the upper part of the wound where the muscle is thick enough we place the interrupted stitches through the lower third of the uterine wall and the continuous stitch through the upper two thirds of the wall. In the lower part of the incision the wall is so thin that we can not suture in layers and we catch the uterine muscle outside of the interrupted stitches and bring it over the first row of sutures. The fascia between the bladder and uterus can be seen as a glistening layer and is always brought over the first row of stitches by means of the second line of sutures, the needle biting into the fascia and muscle with each suture. We have never sewed the fascia as a separate layer feeling that stronger union is attained by the above method.

We formerly used interrupted sutures for both layers as we always did in the classical case, but now use one layer of continuous sutures because the lower segment is at rest and is not apt to snap the continuous suture as could readily occur with the tugging and grinding which occurs during twisting in the body of the uterus. If the incision is carried up into the body of the uterus on account of a large child great care should be used to place the interrupted sutures close together because the motion in the upper uterine segment is different from that in the lower and a serious movement is set up which may actually pull the edges apart if reliance is placed upon a continuous suture alone.

Another point to be considered by one unaccustomed to this operation is that it is easy to overlook an opening in the lower angle of the incision after one has apparently sutured the entire wound. We overcome this by not cutting the lower interrupted stitches and pulling the incision well out from under the bladder in order that the wound may be inspected.

The upper peritoneal flap if there is one is now tacked down over the upper part of the incision by a few interrupted catgut stitches. The lower peritoneal flap is brought up over the upper

limits of the longitudinal incision and stitched with a continuous suture of catgut. The uterus which has been covered with a warm sponge is now cleansed with sponges wet with warm saline solution. The pads behind the uterus are removed and the abdominal wall cleansed. The operator and assistant now leave the table while a second assistant who has up to this time not assisted at the operation removes the clamps and replaces the uterus in the abdomen. Clean towel are placed about the incision. *The surgeon and nurse change their gloves and gowns. A fresh set of instruments are then used to close the abdominal incision with the second assistant acting as first assistant.* By this method the spill is prevented from entering the peritoneal cavity in an effectual manner. There is no danger of the peritoneal cavity becoming infected from either dirty gloves or instruments and the operation is easy to perform.

#### RESULTS OF OPERATION

The number of cesarean sections that I have performed totals 52 at the present time. These represent unselected cases in a large number of which there had been interference before operation. In the early cases attempts were usually made to deliver the child with instruments and when it was impossible a cesarean was decided upon. The classical cesarean was performed until 1920 but it was felt that the risk was too great in the class of cases upon which we were called to operate. There were 6 maternal deaths in the whole series, 5 prior to 1920 and 1 death in 31 operations since 1920 when the technique which has been described was first adopted. The 1 woman who died had had many vaginal examinations and ruptured membranes, the uterus and contents were infected so badly that a hysterectomy was performed and she died in the third week from blood infection.

Of the 5 deaths before 1920, 2 were from peritonitis (postmortem examinations were held in both cases), 1 was from hemorrhage from the uterus on the fourteenth day (postmortem examination revealed no peritonitis, a healed uterine wound and a uterus filled with debris), 1 from eclampsia 2 weeks after operation and 1 patient died on the table as the skin sutures were being tied. The last death was ascribed to pulmonary embolism although there was no postmortem examination.

Two deaths in 21 cases were directly attributed to peritonitis. Thus it will be seen that in my hands at least the classical cesarean carried a very grave maternal risk in infected or potentially infected cases.

The low operation performed as described has evidently lowered the mortality although too few operations have been performed to positively prove this assertion.

I am quite convinced that the technique and not a more careful selection of cases during the last few years has been responsible for the lower death rate in the 31 cases since 1920.

The following cases will at once show the serious types upon which we have been in the habit of performing the operation outlined.

#### CASE REPORTS

The operations in these cases were all performed by H. M. Armitage and F. R. Nothnagle.

A. G. 91 had been in labor for 3 days. The membranes were ruptured and many vaginal examinations had been made. A low cesarean operation by the author's technique was done. There was some slight infection of the wound but no symptom of general infection. The patient recovered.

H. M. 192 with rachitic pelvis had been in labor 24 hours. Forceps had been used. She entered the hospital with a temperature of 100 degrees F. A low cesarean by the author's technique was done. The temperature was febrile for about a week. Patient recovered.

H. E. 1922 was in labor 19 hours. The membranes were ruptured and many vaginal examinations had been made before she entered the hospital. She had had a child 6 years previously, the delivery being very difficult. The head was not engaged. A low cesarean section was done, the author's technique being used. The temperature was 100 degrees F. 1 day following operation and then became normal. There was no infection of the wound. Dilatation of the stomach followed operation and the stomach was washed out. Recovery followed.

A. W. 922. This was a breech presentation with the feet hanging out of the vulva. Two physicians had tried to effect delivery but found it impossible. The patient was very fat weighing 4 pounds. A low cesarean by the author's technique was done and a living child delivered. Stomach anastomosis with great abdominal distention but no difficulty followed. The patient was relieved by a stomach tube. Recovery followed.

H. K. 194. 46 years of age was in labor 2 days. The membranes ruptured 24 hours. The pelvis was contracted. A low cesarean by the author's technique was performed. The lochia was very foul for several days. It was found that there was no infection of the incision and the patient recovered.

M. F. 1924 was in labor 6 hours. The membranes ruptured 1 hour. One examination had been made outside the hospital. The pelvis was contracted. A low cesarean was performed by the author's technique. Slight infection of the wound followed. The patient left the hospital in 6 days.

R. H. was in labor 4 days. Pains were so severe and frequent 48 hours before admission that the attending physician remained at the home of the patient all night. The nurse stated that pains had occurred every 3 to 5 minutes at night before operation. The patient was very weak. The membranes had not ruptured. Many vaginal examinations had been made before admission.

A low cesarean operation by the author's technique was performed and a living child delivered. The temperature



## A ROUND LIGAMENT OPERATION FOR THE SURGICAL CURE OF UTERINE DISPLACEMENT IN SELECTED CASES

By GEORGE L. CARRINGTON, A. M., M. D., DURHAM, NORTH CAROLINA

**D**ESPITE the large number of operations that have been devised for the surgical cure of uterine displacement the pelvic surgeon occasionally is conscious of a lack of satisfaction with the methods at his command. The procedures now commonly employed are concerned with round ligament shortening of some kind as the one in the main have seemed safest and have been attended with best results. The most popular of these are probably the well known Coffey, Simpson and Baldy Webster operations. There are however a great number of other procedures many of them perhaps equally widely known and bearing as distinguished names. Indeed Chalfant in an excellent article published in 1916 mentioned 99 varieties or variations of round ligament shortening employed by as many surgeons the object of the operations being the restoring of the displaced uterus to its normal position. In the hands of competent surgeons good results have followed the use of the procedures now commonly used.

There is however an occasional patient in whom the round ligaments are so attenuated that there remain only a few strands of muscle fiber covered by a fold of peritoneum. When the surgeon opens the abdomen of such a patient he feels that there is need for something more than can be attained by the usual operations. The condition is not very frequent but on Dr Anspach's service at the Bryn Mawr Hospital there were three such patients during a short period of time. In treating the third patient I rather stumbled upon a procedure that seems to me to offer some help in this type of case.

Patient I. J. was a colored female age 28 married. She complained of dragging pains in the back and womb fall. Patient began to have trouble about 3 years ago. She was pregnant and noticed that the uterus would descend to the vulval outlet. She was kept in bed throughout most of the pregnancy. Since then she has had backaches and dragging pains.

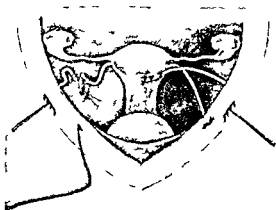
Her general health has always been good. She has been married 9 years and has had 5 pregnancies the fourth resulting in a miscarriage but the other in children who are now living and well.

Physical examination. General physical and laboratory examinations show a well developed patient whose general condition is good. Pelvic examination reveals no discharge, an everted cervical mucosa, relaxed outlet, cystocele, rectocele, descended uteri,

marked retro flexion version. Patient desired to have more children.

The patient was operated upon June 6, 1923 at which time dilatation and curettage, trachelorrhaphy, anterior and posterior colporrhaphy, appendectomy and suspension were performed. The uterus was in a position of extreme retro flexion version and the round ligaments were quite long and small consisting of a fold of peritoneum over the slightest strand of muscle. It was decided to perform a Simpson suspension but in the attempt to bring one of the round ligaments extraperitoneally to the position for suture to the rectus sheath the ligament was torn in two. The procedure employed then was to ligate the round ligament on each side of the tear and to use the free end of the proximal half of the divided ligament for suture to the rectus sheath just as the loop of ligament would have been fixed in the Simpson operation. The distal half of the ligament was then carried over the proximal half and sutured to the anterior surface of the uterus and the two halves sutured together where they were parallel and in close proximity to one another.

To perform the first part of the operation it will be seen that the procedure after division of the round ligament is practically identical with that



**F 1.** The right round ligament has been divided and ligated. An Anspruchs round ligament needle has been passed through a small incision in the rectus sheath and is just emerging through the incision in the peritoneum of the anterior surface of the broad ligament preparatory to drawing through the free end of the proximal half of the round ligament to the rectus sheath. The complete operation is shown on the next page. The proximal half of the ligament being sutured to the rectus sheath and the distal half sutured to the anterior surface of the uterus.

in the Simpson operation. A small incision having been made in the rectus sheath and one in the anterior leaf of the broad ligament an Anspach round ligament needle or a Kelly clamp is passed through the incision in the rectus sheath carried extraperitoneally to the little incision in the anterior leaf of the broad ligament the free end of the proximal half of the divided round ligament grasped and pulled extraperitoneally up to the rectus sheath and sutured to the sheath. The distal portion of the round ligament is then slid over the proximal portion care being taken not to strip back the broad ligament peritoneum from the round ligament. The free end of the distal half of the round ligament is then sutured to the anterior surface of the uterus and the broad ligament peritoneum attached to it also sutured to the uterus. The proximal and distal halves of the round ligament are then sutured together for the distance that they lie parallel and in close proximity to each other. The procedure can be varied by perforating the broad ligament and carrying the distal portion of the round ligament through the perforation and then suturing it to the posterior surface of the uterus thus performing a sling operation somewhat similar to the Baldy Webster combining as it were the Simpson and Baldy Webster operations instead of the Simpson and Coffey as in the present case. The same procedure of course is carried out on both sides.

The only operation that we have been able to find at all similar to this was described by Pankow in 1912. He divided the round ligaments and sutured the proximal end to the internal ring of the inguinal canal and then implanted the distal end into the uterus suturing the two portions together along their course. We do not believe with Pankow that this type of operation should ordinarily be employed but we do believe that a double support of the uterus would be worth while in patients with long greatly attenuated round ligaments as associated with marked uterine displacement. We

are inclined to believe that the operation we have described would give somewhat better support than that described by him inasmuch as the rectus sheath gives a firmer anchorage for the round ligament than does the internal ring of the inguinal canal.

There is some question as to the relative importance of the peritoneal and muscular supports of the uterus. Coffey has thought that in his operation the support was principally by the broad ligaments and that the round ligaments later shortened up after the strain had been removed from them. Goldspohn on the other hand objected to Coffey's statement that peritoneal folds are the true support of abdominal organs. He maintained that rest would not strengthen muscle and that it would not strengthen the round ligaments. Thus far the question remains unsettled so that until the truth is determined the safest plan probably is to utilize all elements of strength obtainable in difficult cases. Repair of the floor of the pelvis and shortening of the uterosacral ligaments are often important factors. But we believe that the procedure that we have described above will also be of use in patients who have very thin long ligaments since it affords a double round ligament support and a double peritoneal support on each side thus giving to the uterus practically the combined support of a Simpson and a Coffey suspension.

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## OBLIQUE GASTRODUODENOSTOMY IN THE TREATMENT OF ULCERS OF DUODENUM AND STOMACH AND CANCER OF PYLORUS

BY A. L. SORESI, M.D., NEW YORK CITY  
 V. ting S. geo. C. ee po. t. H. p. tal. Bookly. N. w. Y. k.

**G**ASTRODUODENOSTOMY is the ideal reconstruction of the passageway between stomach and intestine after resection of the pyloric region. It is ideal because it preserves the physiological relations between stomach and intestine and causes less trauma and shock than does any other procedure.

On account of technical difficulties in its execution and the postoperative complications following its use this ideal procedure is not often resorted to in the surgical treatment of ulcers located in the duodenum or in the stomach near the pylorus or in cancer of the pylorus. We shall not dwell on these points which are familiar to all surgeons doing gastro-intestinal surgery but wish simply to present an improved technique which renders gastroduodenostomy more easy of execution and

more free from postoperative complications than the procedures generally adopted.

The main points of the technique are

1 It is not necessary that the opening in the stomach be narrowed in order to be made approximately of the size of the opening of the duodenum previous to the making of the anastomosis.

2 The duodenum is sutured longitudinally to the posterior border of the stomach and then split open along the suture line.

3 The opening between the stomach and duodenum is not narrowed on the contrary at the point of anastomosis it is wider than in normal conditions.

4 The blood supply along the line of suture is excellent.

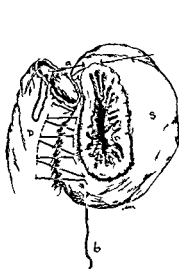


Fig 1

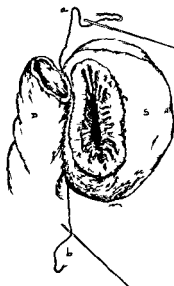


Fig 2



Fig 3

Fig 1 Spec. Im. t. est. sut. re. p. pro. mating. ser. sa. f. poste. r. llofst. ma. b. S. top. to. t. se. o. sa. of. ter. r. will. f. d. od. um. and. t. port. n. f. it. cut. edge. D. The suture. begin. nd. nds. the. stomach. A. ok. : a. mad. Fig 2 Mattres. s. tu. e. pulled. taut. p. pro. mating. ser. s. of. stom. a. h. and. duod. n. m. The. t. nds. of. th. thread. b. re. held. it. ut. by. s. sta. tino. der. to. t. nor. nize.

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Fig 3 The. p. p. ear. n. ce. of. the. stom. a. h. and. duod. n. m. wh. n. the. d. od. n. m. is. incised. al. ng. d. tted. line. sh. wn. in. Fig. 2.





Fig 4

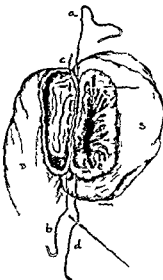


Fig 5



Fig 6 (above) and 7 (below)

**Fig 4** Special mattress deep haemostatic suture. Note that suture is started on the middle of the posterior cut edges two needles being threaded to a strand of catgut, and how the lower angle is easily closed without changing direction of the suture and without placing a yank on it (The needles from the double haemostatic suture are used to simplify the procedure).

**Fig 5** Lower angle closed by pulling the suture taut by needle 'd'. Suture is continued toward the upper angle with needle 'c' and continued all round until it meets point

sewn by needle 'd'. Note that only one knot has been necessary.

**Fig 6** Deep suture closed directed toward the upper angle. The suture is continued with needle 'c' until it meets the point sewn by needle 'd'. Note that only one knot has been necessary.

**Fig 7** Special hemipet taken by stomach and duodenum when anastomosed by the oblique method. This suture favors lateral formation of a true pylorus of normal size.

5 The serosas are broadly approximated by the special double mattress suture used.

6 The disadvantages of the end-to-end anastomosis are abolished but its advantages are retained.

We proceed as follows. After the diseased area of the duodenum or stomach or both is resected the posterior wall of the stomach is sutured to the anterior wall and to a portion of the opening of the duodenum at about 2 or 3 millimeters from the cut edges (Fig 1).

The suture on the duodenum should be made the same length as the opening of the stomach. This suture corresponds to the deep posterior suture used in gastro-enterostomy. The two ends of the suture are not tied; they are pulled gently until all suture material between stomach and duodenum disappears and are held taut by the assistant (Fig 2). The duodenum is cut as shown in dotted line of Figure 2 parallel to the line of suture and at about 3 millimeters from it (Fig 3).

The haemostatic or through and through suture is started in the middle of the posterior cut edges two needles being threaded to a strand of catgut. The suture can be started with either needle and directed toward either the upper or lower angles (In Fig 4 it is directed toward the lower angle). When the angle is completely closed the other needle sutures the cut edges toward the other angle (Fig 5) and suturing is continued until the last stitch made by the other needle is met. One needle should end the suture on the stomach and the other on the duodenum at points opposite one another. The two ends of the thread are tied and cut short. Either one of the two needles threaded to the catgut used for the posterior row of seroserosal suture is picked up and the seroserosal suture is continued about half way (Fig 6) when the other needle is picked up and the suture is finished. The rents in the gastrophatic and in the great omentum are closed and the operation is finished.

*Special considerations* No clamps are used. A retention suture may be applied to the stomach and duodenum or they may be held with towel forceps until the posterior row of the serous suture is finished. Clamps are not only not necessary they are dangerous. Clamps traumatize the cut edges are cumbersome may render very difficult or impossible the making of an anastomosis that can be accomplished very easily if they are not used. The main objection to the use of clamps is that the cut edges are prevented from bleeding during the time consumed in making the deep or hæmostatic suture. The clamp is removed only when this deep or hæmostatic suture is finished and the opening closed and the cut edges out of view consequently *when the surgeon is not sure of the hæmostasis*. He is sure of his hæmostasis instead if his suture has stopped all bleeding while bleeding actually occurred that is during the time he has applied the deep or hæmostatic suture.

The thread used for the posterior row of the serous suture is held taut and exteriorizes the stomach and the duodenum it is ideal for this purpose. Leakage into the abdominal cavity is prevented by washing the stomach prior to operation and properly packing the abdomen. Surgeons will be surprised to see how easily and satisfactorily the stomach and duodenum are exteriorized and leakage is prevented by lifting the stomach and duodenum with the thread used for the posterior row of the serous suture.

Objections that may be raised against the procedure are

1 *The oblique gastroduodenostomy requires more tissue than the end to end*. Gastroduodenostomy is only indicated when the stomach and the duodenum can be approximated without tension. The oblique gastroduodenostomy takes up so little more tissue per se that practically in all cases in which an end-to-end anastomosis could be made also an oblique anastomosis is possible. We feel that the dangers inherent to an end-to-end gastroduodenostomy should lead the surgeon to perform a gastrojejunostomy whenever the stump of the stomach cannot be approximated without tension to the duodenum as required for a safe oblique gastroduodenostomy.

2 *The opening between the stomach and the duodenum is too large in fact much larger than the normal pyloric opening*. The width of the opening must be considered at two different periods namely the first few days after operation any time 1 month or 50 years after the operation. The first few days after the operation the cut edges of the stomach and of the duodenum become

œdematous and are so swollen that the lumen often becomes occluded thus preventing the passage of the stomach contents into the duodenum. We may add that one of the chief objections to gastroduodenostomy is the occlusion of the lumen by the swollen cut edges. This occlusion causes stagnation in the stomach of anything administered by mouth dilatation of the stomach making it impossible to administer not only food but even water by mouth. Consequently in the first few days after the operation there cannot be any objection to the presence of a large passageway between stomach and duodenum on the contrary the larger this passageway the better.

Later let us say 1 month or 50 years after the operation the lumen becomes smaller in all cases on account of cicatricial contraction and proper functions. If the duodenum has been anastomosed to the stomach end-to-end its lumen might and too often does become so narrow that we have the same condition as was met in occlusion of the pylorus due to any pathological cause. If instead the lumen at the point of anastomosis is sufficiently wider than the normal cicatricial contraction will not in all probability cause any dangerous narrowing. Another factor however militates in favor of a lumen larger than the normal pyloric opening. The peculiar shape (Fig 7) taken by the stomach and duodenum at the line of anastomosis does not allow an abnormally rapid emptying of the stomach. This peculiar shape favors a later final improvement of the passageway between the stomach and the duodenum improvement due to the well known fact that the function makes the organ. After several months we have observed that in the experimental animals the lumen had narrowed to almost normal the emptying time of the stomach was normal because a new antrum pylori had formed. This newly formed antrum pylori has the same shape and perhaps the same function as the normal antrum pylori.

#### CONCLUSION

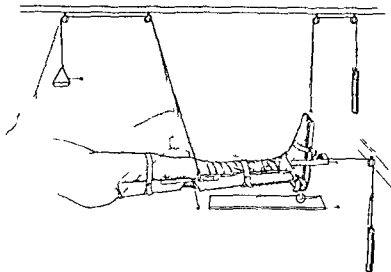
The author feels that the results obtained in experimental and clinical work justify the statement that the oblique gastroduodenostomy is the safest most rational most physiological procedure for the reconstruction of the passageway between stomach and intestine after gastrectomy. Oblique gastroduodenostomy therefore should be preferred to any other procedure whenever conditions warrant its use. Oblique gastroduodenostomy is the ideal procedure for the surgical treatment of large ulcers interesting the duodenum and the pyloric region but not for extensive carcinoma of the pyloric region.

## AN ARTHROPLASTY SPLINT

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IT has been the practice at the Mayo Clinic to start motion in the joint that has been operated on in about 5 days or as soon as the blood clot has become organized. The splint illustrated here has proved to be very satisfactory

thigh in the hip. The roller *b* beneath the foot piece is to prevent friction on the bed clothing and operates on a short board *a* placed on the bed. The Buck's extension *c* is placed on the outside of the foot piece and permits continuous traction



after arthroplasty of the hip or knee. Immediately after the operation a Buck's extension is applied to the leg and then a light cast or a posterior gutter splint. At the end of 5 days this is removed and the arthroplasty splint made of aluminum with a lock joint *d* to prevent hyperextension at the knee is applied. To the upright foot piece is fastened a rope running over pulleys on the overhead frame and to the rope is attached a 6-pound weight *f*. This part of the apparatus prevents rotation of the leg on the thigh or rotation of the

on the knee or hip. Straps are applied to the splint to hold it firmly to the extremity.

Ropes are strung as shown in the diagram and a hand hold *e* is rigged so that the patient can by pulling on it move the knee joint as often and as much as can be tolerated. After arthroplasty of the hip a special abduction Bradford frame is used in order to afford sufficient bed surface on which to operate the splint. An overhead elevating device is preferable since it eliminates all unnecessary discomfort caused by moving the patient.

BLOOD TRANSFUSION TO DATE<sup>1</sup>

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IT is doubtful if the development of any particular phase of surgery has occasioned more ups and downs, more periods of elation and discouragement, more obstacles to surmount and more drawbacks to contend with before success is attained than has modern blood transfusion. Considering in detail the history from its infancy one is deeply impressed by the interesting sequence of events which has terminated in the present day achievements.

Reference was made as early as 1492 (35) to the first transfusion as being given to Pope Innocent VIII by a Jewish doctor, three boys being used as donors. All donors died and the patient was not saved. It is doubtful whether reported transfusions at this early date involved more than the giving of blood as a beverage, as the theory of the circulation was not proposed by Harvey (5) until 124 years later (1616).

In 1864 attempts were made to find an innocuous anticoagulant (27). Sodium phosphate and sodium bicarbonate were used but found toxic in doses large enough to prevent coagulation. It remained for Murphy (32) in 1897 to give the first effective impulse to surgery of the blood vessel by his end-to-end anastomosis. Up to this time the methods were crude and often attended by fatal results, not more than 50 per cent being successful (5). In France at one time transfusion was prohibited by law.

In 1899-1900 the greatest achievement in the history of transfusion was made when the Englishman Shattock (39) and the Austrian Landsteiner (24) simultaneously discovered what was called iso-haemagglutination, i.e. that serum of one individual frequently agglutinates the corpuscles of another individual's blood. This work was put on a firm basis when in 1906 Jansky (21) and in 1910 Moss (31) classified the blood in four groups and thereby made it possible to select a suitable donor and avoid the disaster of hemolysis with some degree of certainty. When Crile (9) in 1907 improved on Quereiro's (13) glass tube method (1895) by using a cannula and performing an intima-to-intima anastomosis of the artery and vein and this in turn was improved by the Carrel suture transfusion might be said to have been established.

Because of the accessibility of the veins Dorland and Ginsburg (12) advocated the vein-to-

vein method as being easier than the artery-to-vein. Janeway (20) further improved the end-to-end method but on account of its drawbacks this method never became practical. From this time on many workers entered the field to devise methods of simplifying the operation.

It remained for Agote (13) of Buenos Aires and Lewisohn of New York when they published the results of their studies and experiences with the sodium citrate method in January, 1915 to open up the larger field of blood transfusion. It is however to Lewisohn that the profession in this country owes its present knowledge of the citrate method. It is from this method that most of the knowledge of the present day transfusion has been accumulated and its use made possible on an unlimited scale.

## METHODS

Method of transfusion are classified into (A) modified and (B) unmodified, the latter into (1) direct and (2) indirect. In the modified form the blood is withdrawn, diluted with an anticoagulant and then injected into the patient. Many reagents have been tried in turn, sodium citrate most successfully. Hirudin is more toxic and the same may be said of sodium phosphate and sodium bicarbonate. Recently Norton (33) of Savannah has used sodium iodide successfully by the syringe method. Some work has been done with sodium sulphate but for some unknown reasons not enough from which to draw conclusions. This anticoagulant is worthy of further development.

Of the unmodified forms the direct or as it is better known, vein-to-vein or artery-to-vein method has already been mentioned. This method has proved so cumbersome, so inaccurate and tedious to say nothing of the skill required in performing it that it has fallen into disuse everywhere except at St. Vincent's Hospital, Richmond, Virginia (18) where it is still used.

A large group of workers unconvinced that the citrate method was adequate and believing in the whole blood theory but wishing to avoid difficulties of the end-to-end method continued their work which has crystallized into the following indirect method of utilizing unmodified whole blood: (A) the syringe method of Lindemann, (B) the parafin tubes of Percy Vincent and Kimpton Brown and (C) an apparatus with the two-way or four-way stop-cock as the Miller (30) and Unger types

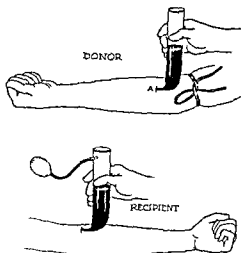


Fig 5 F. M. Brown method

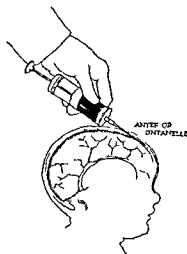


Fig 6 Transfusion into the anterior fontanelle

blood is forced into the recipient's blood stream. Opposite is another connection for a Luer's syringe of 20 cubic centimeter or 50 cubic centimeter size by which normal saline is forced through the tubings to prevent clotting always in the opposite direction from that in which the current of blood is traveling. Only a small amount of saline—2 or 3 cubic centimeters at a time is necessary to keep the channels clear of blood when not in use. To prevent overheating of the blood in the record syringe a spray of ether is constantly played upon the record and this prevents the formation of all clots. For the actual process of transfusion 10 minutes are required for 500 cubic centimeters of blood and 20 minutes for 1000 cubic centimeters. Important precautions to be taken are the following: sharp needles should always be used; the veins should be kept well distended by proper pressure; the whole apparatus must be kept cold; otherwise clots will form by heat and the swivel should be well oiled with sterile olive oil or vaseline.

The ideal method of transfusion should meet the following requirements: (a) whole blood should be used; (b) the blood should not come in contact with the air; (c) only a small corpus should be necessary; (d) the transfusion should be performed with speed; (e) a vessel should not be opened except in extreme cases; (f) the apparatus should be equipped to measure the blood; and (g) it should be possible to perform the operation at the bedside. As to the last it might be said that at St. Mary's Hospital we have found it much more convenient to perform transfusion at the bedside in the ward by the Unger method than by the citrate method.

All the above requirements are met with in the Unger method. By this method the platelets are not destroyed; the coagulation time is permanently shortened (hence its value in hemorrhage) if the blood is properly typed there are no deleterious anti-complements formed in the blood and consequently posttransfusion chills are much less frequently encountered.

#### BLOOD GROUPING

As a routine a Wassermann test should be done only in exceptional cases where time is an all important factor. But in all cases the blood grouping must be done before proceeding with the transfusion. Of the two methods, Jansky's and Moss's, the latter is in most common use in this country and is the method we have used in typing all cases before transfusion. This is based on the presence in the blood of iso-haemagglutinins of which there are two, A and B, providing for 4 possibilities or groups: the presence of both or of either one or of none at all.

CORPUSCLES	SERUMS			
	Group 1	Group 2	Group 3	Group 4
Group 1	+	+	+	+
Group 2	+	+	+	+
Group 3	+	+	+	+
Group 4	+	+	+	+

From this table it can be seen that if we have 2 known serums, Group 2 and Group 3, any un-

The plus sign indicates agglutination. The corpuscles of Group 1 are agglutinated by the serum of Group 2 and Group 3. The serum of Group 1 has agglutinating properties for the corpuscles of Group 2 and Group 3. The serum of Group 2 has agglutinating properties for the corpuscles of Group 1 and Group 3. The serum of Group 3 has agglutinating properties for the corpuscles of Group 1 and Group 2. The serum of Group 4 has no agglutinating properties for any of the corpuscles. As the serum of Group 1 is the serum of the donor and Group 2 is the serum of the recipient, Group 1 is the universal donor and Group 2 is the universal recipient.

known blood corpuscle group can be ascertained. The technique for obtaining the stock solution is as follows: Blood is withdrawn from known cases of Group 2 and Group 3. The blood is allowed to settle or is centrifuged; the blood plasma is then pipetted off and preserved in the ice box and is usable for 6 weeks as stock serum. This procedure can be simplified by the use of the readily obtainable serums which are on the market. When a donor is to be typed, blood is withdrawn from the ear, centrifuged, the serum is pipetted off and the corpuscles washed with saline solution. The donor's corpuscles are now matched with a drop each of the known serums of Group 2 and Group 3 and the reaction noted. If there is agglutination in both it is a Group 1 donor. If agglutination occurs with the known Group 3 serum it is a Group 2 donor. If agglutination occurs with the Group 2 it is a Group 3 donor and if there is no agglutination at all it is a Group 4. Thus it will be seen that Group 4 is the universal donor. When possible a donor of the same group as recipient is elected but a Group 4 may be used if the same group is not obtainable (38). The Mayo Clinic (1) has shown that in their series of transfusions for pernicious anemia patients of Group 1, 2 and 3 were more benefited by Group 4 donors than by their own types.

This grouping is further checked up by matching the donor's corpuscles with the recipient's serum and the donor's serum with the recipient's corpuscles. It must be remembered that the important factor is that the recipient's serum should not agglutinate the donor's corpuscles. We have on several occasions at St. Mary's Hospital when perfect mating donors were not obtainable used donors whose serum showed agglutination with the recipient's corpuscles without untoward but with beneficial result following transfusion.

Immediate hemolysis is to be expected only if the blood of the recipient is highly hemolytic for the erythrocytes of the donor. Under such circumstances destruction of the erythrocytes may follow immediately (22). If the serum is only weakly hemolytic and the blood grouping properly defined hemolysis will occur late often late for a preliminary test (a trial injection of 10 centimeters and observation of the reaction for 10 minutes) to be of use.

When the serum of the blood injected destroys the erythrocyte of the recipient hemolysis does not occur before an hour. The clinical picture is determined by the strength of the hemolytic substances. Depending upon this factor there may be shock with hemoglobinuria or merely a variation in temperature possibly with icterus.

The technique of blood grouping is based on the phenomenon that iso-hemagglutination occurs independently of hemolysis and that hemolysis with few exceptions precedes or accompanies agglutination.

The active life of the red cell is estimated at from 7 to 30 days (40) and is very susceptible to chemical agents and change in the salt content of the blood plasma. Hemolysis, the robbing of the hemoglobin content of the cell with active pathological blood destruction and the release of toxic products in the blood stream. It is the effect on some of the component parts of the cell (8).

Bechold (3) recently advanced the theory in explanation of hemolysis in which he regards the red cell as consisting of a stroma of protein network with a skin of emulsified lecithin and cholesterin across the meshes. He regards hemolysis as occurring when one of these three component parts is removed.

Iso-hemagglutination or clumping of the cells is dependent on both the cells and the serum. It affects the cell as an entity in contrast to hemolysis which affects some of the component parts of the cell. Iso-agglutinins appear in the blood serum of 97 per cent of adults while iso-hemolysins occur in only 5 per cent.

Recent investigation by Dyke, Oxon and Budge shows that the agglutinative properties A and B can never appear in the offspring without having been present in at least one of the parents and when inherited these properties appear in the offspring in accordance with recognized Mendelian laws (4). In considering the group to which the offspring of any two parents may belong it must be remembered that it is not the group that is inherited. The dominants A and B and the recessives a and b are the inheritable factors and it is in the presence or absence of these that the blood group depends. Furthermore in all races whatever the numbers of persons belonging to Groups 2 and 3 those belonging to Group 1 are always the least numerous. Apparently there is some factor that inhibits the ready production of Group 1 and no such inhibition on the parts of the other groups.

That blood groups are inherited and not changed during life was demonstrated by Brines (5) who repeatedly attempted to change the type of an individual by giving repeated transfusions of blood of a different group hoping to cause accumulation of antibodies in the recipient but the attempt was unsuccessful.

Familial relationship has a definite relationship bearing on blood group. Ottenberg (34) after testing a new series of families confirms the heredi-

itary nature of human groups and suggests its medico legal application for the detection of parentage. Buchanan (6) holds that Ottenberg's application of blood groups for the determination of the legitimacy of offspring is dangerous. Further work on this subject is necessary (19).

Bauer (2) from his extensive work on 233 hæmophilic families so far known gives us the interesting conclusions on hæmophilic heredity. In hæmophilia the sexes are reciprocal: the males are the bleeders but do not transmit the condition while the females who transmit the condition do not bleed. In his opinion the hæmophilia factor is coupled with the sex factor and is a recessive lethal factor.

According to the theory of the biology of heredity all transmissible qualities are found from the first nucleus division in the chromosome constituents of all other cells of the organism each body cell inheriting the entire original chromosome combination. Accordingly the hæmophilia factor is present in every cell of the body.

#### REACTIONS

Following blood transfusion reactions are not infrequently met with and may require combative measures. A reaction may vary from one of slight significance to one of alarming proportions and may appear during the process of transfusion or it may be delayed for a period of 24 hours. In the very mild form in which the patient may experience a sensation of chilliness a few moments duration and may exhibit a rise in temperature of 1 degree no counter measures are required. If the reaction is of a major character with a rise of temperature of 3 degrees and a chill from 10 to 30 minutes in duration stimulating and supportive measures should at once be instituted.

Reactions are primarily due to error in the laboratory in the typing of the blood. This is avoided by frequently testing out the stock serums used so as to avoid the use of one that has deteriorated by age and by performing the typing at room temperature 37 degrees C. as below this temperature typing is inaccurate. With careful and accurate typing in our laboratories reactions from incompatibility now rarely occur except in a few isolated para groups.

In the citrate method the chilling of the blood during the transfer from donor to recipient is given by Lewisohn (2) as more frequently the cause of reactions than any other factor. It is difficult to overcome this obstacle.

The chemical reaction of the sodium citrate salt itself upon the blood platelets is perhaps the largest factor producing the reaction. As the

blood platelets are destroyed toxic by products are liberated into the plasma with their deleterious after effects. Mellon (29) has shown that the hydrogen ion in sodium citrate differs in different specimens of that salt and it is doubtful whether unvarying solutions of that salt can be produced. In our experience with the sodium citrate method a high percentage of reactions have followed the transfusions.

Again certain reactions are due to the chemical action of the blood on the rubber tubing (7) used during the transfusion. This is easily overcome in the Unger method by using for each operation new tubing which has been boiled in sodium chloride solution for 30 minutes.

Reactions also occur when transfusions are performed within 24 hours after the patient has received ether anaesthesia (26) after the ingestion of certain articles of diet that increase the protein sensitization of the blood or after bacterin serums, antitoxins and coagulants have been used for septicæmia, toxæmia, diphtheria and hæmorrhage.

#### INDICATIONS

The field for blood transfusion which originally seemed limited to hæmorrhage and great loss of blood now that its vast benefits are recognized has come to include many surgical conditions and a variety of purely medical diseases.

We are all familiar with the case that has been bled white, is exsanguinated, pulseless and at death's door showing a brilliant result following transfusion by a glow in the facial color, a return of the pulse and a restoration of the life. Death in hæmorrhage is due to the starvation of the tissue cells from the lack of oxygen. When now we throw millions of new oxygen carriers in the form of red cells into the blood stream we not only restore the volume but at once inject the indispensable oxygen into the tissue cell. In severe hæmorrhage when 1,000 to 2,000 cubic centimeters of blood has been lost 1,000 cubic centimeters or in extreme cases by the use of several donors at the same transfusion 2,000 cubic centimeters may be used. Hallbertsma (16) found that to increase the blood count by one million red cells per millimeter it is necessary to transfuse 15 cubic centimeters of blood per kilogram of body weight. Transfusion should be done in all cases with a hæmoglobin under 40 per cent and a red count under 2,000,000 and greater benefit is derived if the red count is even higher. Such hæmorrhages may result from uterine origin, gastric or duodenal ulcers, pulmonary factor, nephritic and bladder hæmorrhages, ruptured ectopic pregnancies, postoperative bleeding and loss of blood from trauma.

as in industrial injuries. Most of the transfusions we have done have been for uterine hæmorrhage, two were for hæmorrhage from duodenal ulcer.

In shock, whether of postoperative or other surgical nature, transfusion is of great value in restoring blood pressure and the oxygen carrying content of the blood. In the Woman's Hospital, New York, donors are typed and held in waiting in cases where postoperative shock is anticipated. Low blood pressure is the indication for transfusion in postoperative shock.

As an anticoagulant to arrest bleeding in hæmorrhage it is unexcelled. In one of our cases of hæmorrhage from duodenal ulcer in which profuse bleeding through the intestinal tract continued for 8 days, calcium lactate was given for 3 days, 3 intravenous injections of thromboplastin were administered on the 2 following days, on the next 2 days two intravenous injections of normal horse serum were given all without effect as the stools continued to show clots of blood for more days and the patient was exsanguinated. A transfusion was followed by immediate control and no more bleeding occurred for 1 month when the patient was operated upon. The arrest of the hæmorrhage due to the production of new thromblastic material from donor to recipient.

In pernicious anemia transfusion replaces the erythrocytes whose destruction exceeds their production. It increases the blood volume which in most cases is reduced (10). It furthermore stimulates the hæmatopoietic organs as is demonstrated by the increase of polymorphonuclear neutrophile platelets and reticulated red following transfusion (37).

In septicæmia it has not given gratifying results unless as Unger suggests the donor is first immunized with the organism obtained from the patient's blood (42). Under these circumstances he reports 5 recoveries out of 7 cases. We recently used transfusion in a case of induced septic abortion in which the temperature was 104 and the pulse 146. In 24 hours the temperature dropped to 99 and the pulse to 100 and complete recovery followed. In another case in which operation was performed for acute osteomyelitis, 3 days after the operation the patient was in hopeless condition with temperature of 105 and pulse 150. Transfusion was done but the case terminated fatally 12 hours later. Our experience with mercurochrome in septicæmia of uterine origin has been no better than with transfusion but we have had excellent results from the intravenous use of tenth normal saline solution.

In obstetrics there are many indications (43) for the use of transfusion including preoperative

preparation, placenta prævia and mæna neonatorum (44).

It is valuable in anæmia of tuberculosis and nephritis and in gas poisoning (11) when accompanied by venous section. In anuria and uræmia repeated venous section with repeated transfusion has proved successful (4) and the transfusion is just as important a factor in stimulating the flow of urine in the kidney as decapsulation. In pregnancy with threatened abortion from severe acidosis transfusion from the donor who has been alkalinized by repeated doses of sodium bicarbonate (15) has prevented the abortion and preserved the pregnancy.

In infants with malnutrition and infantile atrophy transfusion has saved many otherwise hopeless cases. In the extremely young where the arm veins are inaccessible the transfusion may be made into the femoral, jugular or the superior longitudinal mus (25). In (a) sepsis from superficial burns, (b) erysipelas of the newborn, (c) acute septic scarlet fever and (d) acute intestinal intoxication (36) exsanguination transfusion has reduced the mortality rate to startlingly lower figures. By this method septic blood is withdrawn from the patient (usually an infant) until the point of exsanguination has been reached and then blood equal to the amount withdrawn is transfused.

Other use for transfusion as in pneumonia, typhoid fever etc. are dealt with in the literature.

Our experience with transfusion of blood has been equally divided between Lewisohn's citrate and the Unger whole blood method in cases of hæmorrhage from the uterus, hæmorrhage from duodenal and gastric ulcers, osteomyelitis, postoperative shock and in anæmia, cachexia and sepsis following induced abortions. From our experience and studies we have come to the following conclusions:

#### SUMMARY

1. Whole blood should be used in transfusions.
2. The Unger method is displacing the citrate method and is the method of choice.
3. Sodium citrate is destructive to the blood platelets and increases the fragility of the erythrocytes.
4. Blood group cannot be changed during life. The agglutinable properties A and B cannot appear in the blood of the offspring without having been present in the blood of the parent.
5. Blood grouping should be done at room temperature (37°C) and stock serum frequently tested to avoid deterioration.
6. A donor whose serum agglutinates the corpuscles of the recipient can be used and is not



contra indicated if a donor of complete mating properties is not conveniently obtainable

7 Transfusions should be used less as a last resort and more as an early therapeutic measure and in a greater variety of cases

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- 22 L A N D Y I N E R C Z u k n n t n i s s d e a t f e r m e t t n  
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- 23 L A N D Y J D A p l u m a n r y r p o t b l o o d t n s  
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- 25 L E W I S O N R C r i t m e t h o d f b l o o d t r a f s  
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- 26 L I D E M A E T a l b l o o d l m i n p e r m c s  
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- 27 M E L L O N R R S L A G L E A d A C R E S F  
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- 28 M I L L E R G J B l o o d t r a f f n L e g l l d M J  
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- 29 M S S S t d n s o g g l t B l l J o h H p  
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- 30 M U R P H J B R s e c t n f a t n e s d a s j u r e d  
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- 32 O T T E N E R E L E V M l l g l p p l t f  
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- 33 P E M R O V J d e J B l o o d t r n f o n C i l l e d  
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- 34 R O R S B P s g u n t o n t f u n  
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- 36 S F O R D A f f s i t f t h d f e f f n  
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- 39 U G E L J P e c t n e c s a r v l t f  
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- 40 I d m T h t f f l o o d f m m n i z e d  
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- 41 W I L L M O H C T h s e f l o o t r f  
b s t t r a n d g v l g v A m J O b t & G y n e c  
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- 42 W O R M H T f b t h t r a t m t h o d A  
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## EDITORIALS

### SURGERY, GYNECOLOGY AND OBSTETRICS

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OCTOBER 1925

#### USE OF LUGOL'S SOLUTION IN EXOPTHALMIC GOITER

PUMPHREY in 1912 advocated the use of Lugol's solution in exophthalmic goiter to quiet down the storm of acute hyperthyroidism and prepare for operation.

It was but a few years ago that the administration of iodine to an acutely sick exophthalmic goiter patient was strongly warned against because it was thought that the disease was due to an excess of the normal product of the thyroid in the body and it was known that this product contained iodine. The use of iodine as a skin disinfectant and of iodized catgut was given up in many clinics. Hummer noticed, however, that the administration of a dose of thyroxin to an exophthalmic goiter patient produced no exaggeration of the symptom and because of this he realized that some of the typical symptoms of exophthalmic goiter at least must be due to an abnormal product of the gland, he kind, he started to administer Lugol's solution. He was very definite the result that exophthalmic goiter is due to an intensive stimulation of the thyroid under which the gland delivers not only an excess of its normal prod-

uct but an abnormal product which is an incompletely iodized thyroxin molecule and that the symptom complex of exophthalmic goiter varies with the relative amount of the normal and abnormal uniodized thyroxin molecule, the latter giving rise to the characteristic nervous and eye phenomena of exophthalmic goiter which Lugol's solution has been found to control so well. If the thyroid is well trained to this intensive stimulation the product of the gland is essentially normal—though excessive and postoperative deaths are rare in spite of the high basal metabolic readings. If the thyroid is not well trained the stimulation produces an excess of the abnormal secretion and postoperative deaths are common and are due to the reaction that occurs in the patients overloaded with this abnormal product.

It is most astonishing to observe the change that takes place in the condition of the acutely sick exophthalmic goiter patient after the administration of Lugol's solution for 6 or 7 days to witness the improvement in the nervous system of the patient as the pulse and metabolic rate fall. It is not unusual to prepare patient with a metabolic rate of well over plus sixty and a pulse rate of one hundred and thirty or higher for a safe thyroidectomy after a week of preliminary preparation with Lugol's solution, all of whom with the former method of preparation would have had single or multiple ligation with angle or double lobectomies performed months after the ligation with the morbidity extending over a year in some instance.

By the use of Lugol's solution the need for ligation has been greatly reduced and the

percentage of ligations has fallen from 50 to 60 per cent in some clinics. In the writer's opinion ligations should not be entirely abandoned but should be held in reserve as a safe measure for the critically sick patient and for the occasional one who does not respond to the Lugol's preparation.

One frequently sees a case *in extremis* upon admission—deep in the throes of a crisis—improve so much under the iodine preparation administered by the rectum or by painting large areas of the skin with the tincture of iodine while the vomiting lasts that operation may be performed safely at the end of 2 weeks. Before we used the iodine preparation the treatment of such a case was about as successful as was the treatment of a patient in diabetic coma before we had insulin. When one can operate safely upon such cases now it is extremely difficult not to become enthusiastic over the whole subject.

Just a word of warning. With the general employment of iodine in goiter prophylaxis and with a vague understanding which many have that Lugol's solution will cure goiter one sees many patients who are harmed by the incorrect use of iodine. It is well known that quiescent adenomatous goiters are made toxic by the use of iodine; the effect of iodine upon the active adenomatous goiter is still a debated question. There are some investigators who think it does harm; others who think it does not. Many colloid goiters in patients over 25 years of age contain small adenomata and these patients are harmed by the administration of iodine.

The writer has been amazed very often to find the large dose of iodine which are given to patients for long periods of time without further examination or observation of the patients by physicians who have but little knowledge of goiter pathology. The reluctance which some surgeons have to administer

Lugol's solution may be due to the fact that they have witnessed the harm which arises from its incorrect use or by using it incorrectly themselves.

Lugol's solution given to exophthalmic goiter patients exactly as Plummer advises greatly reduces the mortality and morbidity of the disease. The writer considers it the most valuable contribution of the many which Plummer has made to the study of this obscure and treacherous disease.

DONALD GUTHRIE

### BORDERLINE CASES

*The surgeon can judge safely and correctly of the state of his patient only when he is at the same time a physician. Moreover the physician who refuses to treat surgical patients and attends solely to the treatment of internal diseases must have some surgical knowledge or he will make the grossest blunders.*—Billroth

WE have been accustomed to speak of certain cases as being on the borderline between medicine and surgery. The divergence must be in the way of treatment because in the bright lexicon of diagnosis there are no such words as medical or surgical. As doctors we must meet on a common ground and exit for a common purpose. We must focus ourselves on the patient and ask ourselves not how we can parcel him out but how we can best cure him. It is not all of medicine to write a prescription nor to take the blood count; neither is it all of surgery to cut out all of operating to have the patient get well of the operation.

All cases can be divided into three main classes: first, those that are frankly medical or at least those which it is necessary and proper for the practitioner of medicine to treat; second, those that are on the fence in which both medicine and surgery are needed.

and third those that are obviously surgical either at the beginning or at some time during their course.

I refer first to those cases that are considered to be in the province of the medical practitioner whether he be an internist or one of that lot tribe who attend to the wants of men from door to door. The only real specialist now left is the general practitioner. The diseases are his province: pneumonia, typhoid fever, influenza, meningitis, malaria, the diseases of childhood, and the chronic degenerative ailments.

The complication of these conditions however may be surgical at any time, not to be treated necessarily by the specialist but by the practitioner himself. These complications must be looked upon with the mechanical eye. There are certain conditions with which every internist and every medical man should be familiar but they are more or less surgical and must be treated by either manipulative or operative surgery. There are operations which the practitioner should perform but he must not call this minor surgery. Minor surgery is that branch of the art which is done by the minor surgeon and the more minor the surgeon the more major the operation will become before he is through with it. The real surgeon is content to say that he is trying to do surgery. He does not attempt to separate it into degrees. There is no other department of medicine which is so divided. Do we hear of minor neurology or major ophthalmology? Do we hear of minor medicine and major medicine? Let us be as kind to the surgeon.

There should be a tremendous field for the medical man, the man with the medical mind in the after treatment of the surgeon's patients. Most of the best operators are not the best therapists. One should have around him his best prepared internist, not alone for the cases that are doing poorly but also for those

that are doing very well to keep them from doing poorly. He knows something about stimulation or the avoidance of it and he will carry the patient along with that insight into his comfort that we do not always possess.

There are certain types of cases in our second class which may be designated as those on the fence. Those are the cases in which both the physician and the surgeon are needed in the closest association. Reference need be made to only a few of these types to illustrate what is meant: cases of involvement of the thyroid body, the stomach and its related organs, the gall bladder, the prostate gland and the abdomen.

The thyroid gland, the governor of the engine—it is shaped like one—is the enigma of the human body. When we say that all thyroid cases should be submitted to surgery or that none should be or that the X-ray or medicine will cure them all, we are certainly far from the truth but if we say that all of these agents or methods have their place in certain cases we are very near it. The recent revival of the administration of iodine in exophthalmic goiter brings us back to the time when it was considered very improper to put such patients on that treatment. Thirty years ago when some of the older doctors were treating their patients in that way a number of them got well. We have now come to know that it has actually cured types of this disease which makes us realize that there is nothing new except what has been forgotten.

The stomach sounds the alarm for the rest of the body and it is well to remember that when a patient complains in the region of the stomach the pathology may not be in the stomach. A sickening sight, a foul smell, shocking news may first be felt in the gastric region. There are only two real diseases of the stomach, cancer and ulcer, and those are so related to near by and distant pathology that

we should begin our search for stomach conditions somewhere else than in the stomach.

Disease of the prostate gland is not always surgical. There are some cases that do not get to the surgeon and there are some that should not get to him. We remove the prostate gland and sometimes the patient does not get well. We must think of the things back of it all. Those are the things that will sometimes kill the patient with or without removal of the gland and are to be taken thought of by the surgeon as well as by the physician.

All the cases of abdominal ptosis are certainly on the borderline—they are amorphous. Whenever we see a surgeon do a hammock operation we wonder if the patient had not better be put into a hammock on the porch rather than have several hammocks hung inside of her. The visceroptosis may be part of a general derangement, the result of loss of nerve tone or of deficiency in fat, and whenever the things themselves are corrected we may not worry over the ptosis. We have a right to ask whether the ptosis causes the neurosis or whether the fact that the patient is neurotic is behind the whole affair. We see this condition in patients with a long waist, drooping shoulder, slanting abdomen and invariably so far as I have seen they are of the neurotic type, either the still the excited or the depressed variety. At any rate if we should have this condition ourselves we might prefer to lift the foot of the bed and sleep that way for several months, take an alkaline bitter tonic, wear an abdominal support and drink buttermilk and some oily material rather than submit to multiple plicating operations.

3. The last class, those conditions that are frankly surgical in the beginning or at some time during their course include appendicitis, gall stones, intestinal obstruction, hernia and tumor, both benign and malignant. We all might agree that these represent the common

illustrations of conditions which are purely and perhaps only remediable by surgery.

A most difficult diagnosis to make is chronic appendicitis. We are frank to say that we shrink from operating for chronic appendicitis unless we can prove that at some time the patient has had a definite attack, watched and supervised by a competent physician. Even then we might have our doubts. The only thing we can be sure of is to practice the art of exclusion and then after eliminating every possible cause for the symptoms perhaps we can be persuaded that the appendix might possibly be removed.

Gall stones, purely an incident in gall bladder infection, usually have to come out because they produce pain and sometimes the gall bladder should come out with them and sometimes it should be left in.

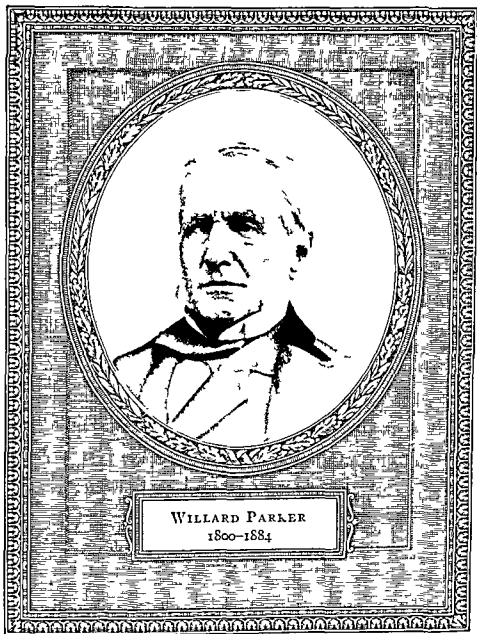
Intestinal obstruction when fecal impaction is ruled out is so definitely a surgical disease that comment seems unnecessary.

Hernia is always a surgical subject whether remedied by mechanical or operative means. We feel sure that every surgeon agrees that trauma is not the original cause, that every case would be better operated upon early in life to prevent all the possibly dangerous sequelae which may come with age and that our results usually are good.

The breast may be taken as an example in which both malignant and benign tumors occur and we may thank the propaganda recently started for the large number of benign cases we are now getting in spite of the too great prevalence of the well advanced malignant ones. There is only one thing to say and that is that every lump in the breast should be removed and that all growth in the borderland of possibly malignant should have a radical operation performed on them coupled with everything else we can do for the patient.

HENRY A. J. 1931





WILLARD PARKER  
1800-1884

# MASTER SURGEONS OF AMERICA

## WILLARD PARKER

THE nobility of the soul the loftiness of the ideals the force of the character and the influences of the life of an illustrious man of the past can be vividly portrayed to posterity no more aptly than through the voice of the man's contemporaries. Thus for telling truly and graphically the tale of the distinguished life of Dr Willard Parker there have been selected from the memorial address to the latter delivered before the New York Academy of Medicine by his intimate friend Dr William H Draper<sup>1</sup> the following passages:

Nearly six months ago that familiar and honored name Willard Parker was blotted from our roll but in our memories it is so deeply graven that the sound of it will always recall to mind one of the most notable figures in the circle of distinguished men in which he moved for so many years. He filled perhaps for a long period a larger place in popular and professional esteem than any of his contemporaries not because of his superior genius nor because of great acquirements but rather because of a character that somehow grasped at once the affections of his fellow men and made them trust and honor him.

and yet there are few perhaps who lived nearer to him than I did for more than thirty years no one I am sure he inspired with a warmer affection or more exalted regard. I can only crave your indulgence if I seem to exaggerate his virtues or to overestimate the influence which he exerted for more than forty years in this city as a physician and a public teacher.

The story of Dr Parker's life is not so remarkable for the incidents or even for the achievements of his career as it is for the singular power he wielded in his professional relations to his patients his pupils and the public through the simple force of his personality.

He was born with the century which his life nearly spanned in the town of Lyndeborough New Hampshire. He was inspired by his Puritan forefathers with the love of freedom and the dignity of labor. He tilled the soil on his father's farm. He prepared himself for college with the rewards of his own toil and graduated at Harvard in 1826. His ardent religious nature inclined him to the profession of the ministry but an incident in his Freshman year happily diverted his thoughts toward a calling in which his mind escaped the fetters of

<sup>1</sup> T. M. Soc. New York & Stat. 88 p. 8



dogmatic theology and left his religious enthusiasm free to expend itself in practical Christianity. One of his classmates had a strangulated hernia the local physician called to his aid the celebrated Dr. John Collins Warren and young Parker was so powerfully impressed with the sagacity and the skill of the surgeon who speedily reduced the hernia that he at once resolved to devote his life to the study and practice of the healing art. Shortly after receiving his degree (Harvard 1830) he was appointed Professor of Anatomy in the Berkshire County Medical College at Pittsfield Massachusetts at that time one of the leading schools in the country.

In 1832 he was appointed Professor of Surgery in the Pittsfield school and for four years he held both chairs lecturing twice daily. In 1836 he moved to Cincinnati where he was called to the Professorship of Surgery in the Cincinnati Medical College. He remained there for three years. It was during this period that he visited Europe and spent some months in observing the methods of the foremost surgeons of that time in England and France. In 1839 he was called to fill the chair of Surgery in the College of Physicians and Surgeons in this city and here for more than thirty years he labored with unflinching zeal as a teacher of the principles and practice of surgery.

His fame as a brilliant lecturer and an accomplished surgeon his noble presence and the wonderful charm of his manner soon achieved for him all the success to which the highest ambition could aspire and amid all the temptations of personal popularity and pecuniary ease he never lost his enthusiasm or abated his labors in behalf of the object which was always nearest his heart the elevation of the standard and the improvement of the methods of medical education.

In connection with the late James R. Wood he reorganized the old Alms house at Bellevue into a Hospital and served there for many years as one of the attending surgeons. He was appointed an attending surgeon of the New York Hospital in 1856. On the establishment of St. Luke's the Roosevelt and the Mt. Sinai Hospitals he was made a member of the staff of consulting surgeon in these institutions. Indeed he was so identified with the growth of charitable enterprises in the way of hospitals and dispensaries in this city that he was associated with the organization of almost all of them. He was one of the first and for many years one of the most active members of the Pathological Society and of the Medical and Surgical Society. His deep and abiding interest in this Academy is known to you all. He was one of its honored Presidents.

He resigned the active duties of his Professorship in 1870 and was made Emeritus Professor of Surgery. He was made a Doctor of Laws by Princeton College in 1870.

He was essentially a broad man with an unbounded faith in the possibilities of the science of healing and an enthusiasm that disappointment never abated and failure could not quench. He could not be called a learned man but

he was what some learned men never become a wise man He acquired his art mainly at the bedside and it was there that he displayed most conspicuously the qualities which gave him his high claim to distinction as a physician and surgeon He was always self possessed no emergency disconcerted him no difficulties appalled him He was uniformly calm and master of the situation He was a keen and comprehensive observer He was sagacious in diagnosis

No one who has ever seen him enter a sick room can forget the magical influence of his alert and cheerful presence It was as if he brought with him the talisman of health It banished fear and inspired hope

It was in his character however as a public teacher that Dr Parker impressed himself most powerfully upon all who came within the sphere of his attractions He loved to teach There was something about his enthusiasm that was contagious He was the pioneer in introducing clinical lectures into the college instruction When he entered the amphitheatre his presence seemed to fill it he riveted attention His glance was an inspiration and his voice like the voice of a prophet His manner toward his patients commanded confidence and assured sympathy

He never lost an opportunity to impress upon his pupils the limitations of the cure of disease as contrasted with the ever widening possibilities of its prevention

It is to be regretted that Dr Parker was not gifted with a faculty for literary work He was singularly free from prejudices and ever ready to acknowledge that new ideas and new methods might be better than the old

Dr Parker may be said to have originated the operation of cystotomy for irritable bladder and the operation for perityphlitic abscess the latter in 1864 which it is certain that he was not aware that Mr Hancock of London had done successfully in 1848

He was a man of public spirit He was interested in all great social questions The public health was to him a subject of the deepest concern To him and the late Dr John O Stone we owe the reorganization of our Health Board

He recognized in the reckless use of alcoholic stimulants one of the chief causes of physical degeneracy as well as of the poverty and crime in our times and he showed by his denunciation of intemperance his exalted conception of the duty of a physician as the conscientious and uncompromising guardian of health He was for some years the president of the Inebriate Asylum at Binghampton

He was generous truly to a fault he was quick to recognize merit and encourage it He loved to do a kindly act and to speak or write a friendly word

He was conspicuously the friend of young men

We are impressed chiefly by his ardent love for his calling by his entire devotion to its high behests and by the singular purity and nobility of his per-

sonal character To these he owed his eminent success in his profession his title to rank high as a physician and teacher and his acknowledged position in the community as one of its most valued citizens He dedicated himself to his work with his whole heart and mind and strength He never wearied in his efforts to augment its usefulness to maintain its honor and to exalt its claims to public confidence

He was always aspiring to a clearer vision he was free from the fetters of jealousy and conceit and untrammelled by the clogs of self indulgence He served his fellow men he strove to be a lamp unto their feet and a light unto their paths

Dr Parker died in 1884 A portrait of him hangs in the Surgeon General's Library at Washington The Willard Parker Hospital for contagious diseases of the Health Department of New York City was erected in his memory

This record of accomplishment and of influence exerted by Dr Willard Parker furnishes a striking example of the capacity of a single individual to do good by a well spent life Lives like this one so rich in kindness and love for one's neighbor coupled with force of character directed for good can well be kept before the public mind down through the ages as an inspiration to all in every walk of life

WILLIAM CHITTENDEN LUSK

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD MAY 15 1925 DR CAREY CULBERTSON PRESIDING

### SPECIMEN OF CARCINOMA OF THE APPENDIX

DR W C DANFORTH This is a specimen from a woman 74 years of age whose previous history was of no importance. She consulted her physician because of enlargement of the abdomen and obstinate constipation. A mass was palpable in the abdomen. X-ray showed some impingement on the sigmoid. She was rather thin and the mass could be felt most prominently on the left side. It was suggested that she had a carcinoma of the ovary which was probably not operable. The abdomen was opened and a large mass occupying the left half of the pelvis was found. There were numerous metastases in the abdomen. About the eighth or ninth postoperative day she had a little hypostasis in both lungs and died quite suddenly from rupture of the left ventricle caused by an occlusion of the coronary artery. The specimen presented is a carcinoma of the appendix. There were also large secondary masses in the omentum which were firmly adherent to this mass. This is the second carcinoma of the appendix that I have observed.

The other case was relatively non-malignant. The appendix was found to contain carcinoma but the patient has remained well.

### SPECIMEN OF CARCINOMA OF THE APPENDIX

DR SYDNEY SCHUCHET This is a specimen of primary carcinoma of the appendix found on routine examination. The majority of these cases are clinically benign. However 6 per cent of the cases recorded show metastases. Probably the case which Dr Danforth reported belonged to this group.

### REPORT OF A CASE OF NATAL TEETH

DR SCHUCHET The mother was a multipara and when the child was born two lower incisors were present. This is a comparatively rare condition. In the literature of the Paris Maternity Hospital during a period of 10 years there were only 3 cases; 1075 babies.

DR BAER This condition is not rare.

### HEMATOSALPINX RUPTURED CORPUS LUTEUM

DR J P GREENHILL The two specimens are taken from patients who had symptoms and signs

of an ectopic pregnancy but in whom operation revealed pathological conditions much more unusual than those ordinarily found in extra uterine pregnancy.

One patient had had a full term intra uterine pregnancy 17 years ago and an ectopic pregnancy in the right tube 1 year ago. Dr De Lee terminated the tubal pregnancy by a partial salpingectomy. The patient this time came to see Dr De Lee saying she had an ectopic pregnancy on the left side. She had been bleeding for 27 days. Pelvic examination revealed a tender, doughy mass on the left side. I punctured the cul de sac to see if there was any blood in the peritoneal cavity. No blood was found so I performed a posterior colpotomy and made a careful examination. I found on the left side what I thought was a typical unruptured tubal pregnancy. The mass measured about 8 by 4 by 4 centimeters. A laparotomy was performed. The ovary on the right side was normal and to it was attached the preserved proximal end of the right tube. On the left side was the enlarged left tube which was felt through the colpotomy incision. The left tube and the left ovary which was cystic were removed. Examination of the tube showed it to be a hæmatosalpinx with no evidence of a pregnancy.

The second specimen was from a patient 34 years old who had 3 living children.

Twenty-seven days after her last menstrual period she had a sudden attack of abdominal pain following which she fainted four times. Two physicians were called both of whom made a diagnosis of acute appendicitis and advised operation which the patient refused. Dr De Lee examined the patient on admission to the hospital and felt a tender, doughy mass on the right side which he diagnosed as an ectopic pregnancy. He referred the patient to me. I made a pelvic puncture and found old blood. I performed a laparotomy and found an unusually large amount of free and clotted blood in the peritoneal cavity. The left adnexa were negative. On the right side was a large blood-clot adherent to the ovary. When this clot was removed there was revealed a large corpus luteum with a long rent in its outer edge. The blood in the peritoneal cavity had come from this tear. The right tube was edematous and reddened. Both tube and ovary were removed on suspicion of a possible ovarian pregnancy but sections of the ovary showed only a corpus luteum with a large tear in its surface.

## DISCUSSION

DR MARK GOLDSTINE Is it a routine practice to make a vaginal puncture in every suspected ectopic pregnancy? If you find blood and you have not an ectopic of what value is a vaginal puncture?

DR EMIL REIS Will Dr Greenhill tell us something about the history of menstruation in connection with these cases?

DR C E PADDOCK Do I understand that unless you find blood you do not operate? Undoubtedly a majority of ectopic pregnancies are destroyed early and cause no trouble but when the diagnosis is doubtful the abdomen should be opened.

DR J P GREENHILL (closing the discussion) I did the punctures because Dr De Lee asked me to and because we do pelvic punctures in nearly all the cases where extra uterine pregnancy is suspected. If old blood is found we operate. If no blood is found we usually wait. In the first case I followed the puncture by a posterolateral colpotomy and outlined the tubal mass with my finger in the peritoneal cavity.

In answer to Dr Reis the first patient had her last period March 18 when she began to bleed and bled until she came to the hospital on April 14. Pelvic puncture was done 3 days after admission. The March period came 3 days earlier than it was expected. The patient complained of severe backache her breasts were enlarged and she felt she was pregnant but in an abnormal way.

The second patient had her last period on March 23. She had an attack of pain and fainting on April 10. She had no external bleeding whatsoever and I operated on her the day she came in. The corpus luteum was about 2 centimeters in diameter and corresponded in appearance to what is generally found at the premenstrual phase of the menstrual cycle.

If old blood is found in suspicious cases we always operate. If blood is not found Dr De Lee usually waits. He has had a number of cases during the last few years in which he has obtained dry taps. He did not operate and according to the subsequent history of the patients nothing developed. We consider a pelvic puncture as we do a laboratory test or a ray that is an additional means of arriving at an accurate diagnosis before operation.

## FETAL HEART SOUNDS AS A DIAGNOSTIC AID

DR LOUIS RUDOLPH The location and the intensity of the fetal heart sound in obstetrical diagnosis have not received enough attention. Since Mayor of Geneva described the fetal heart sound in 1818 and Lejumeau de Kergaradec published his monograph in 1822 very little has been added to our knowledge in the interpretation of the fetal heart sounds.

In pregnancy the fetal ovum is in a known position and presentation may have an associated minor degree of deflexion. A delay in the progress of labor gives the suspicion that the fetal os is complicated

with a slight degree of deflexion. When the head is high and the cervix is not sufficiently dilated for palpation of the sutures and fontanelles the location and the intensity of the fetal heart sounds is an aid in determining the cause of delay in the progress of labor particularly in these days when rectal examinations are largely used in the conduct of labor.

The variations in the transmission of the fetal heart sounds which are heard externally follow certain laws governing the transmission of sound. The intensity as well as the direction of the sound is dependent upon the conductivity of the media intervening between the cardiac chamber where the sound is produced and the external abdominal wall. Irrespective of the presenting part the fetal body may be in an attitude of flexion or extension. Therefore the fetal heart sounds from the cardiac area are transmitted to a point on the anterior or posterior fetal thoracic wall (Fig. 1).

The fetus being in either an attitude of flexion or extension is usually in contact with the uterine wall and where this point of the uterus comes in contact with the abdominal wall the point of maximum transmission is located. Therefore the maximal sounds are transmitted from the fetal cardiac area respectively through the fetal back, chest, the uterine wall and the abdominal wall. The intensity of the sounds will depend upon the intervening media (intestines and liquor amni) and the character of the abdominal wall. In the literature the location of the points of maximum intensity of the fetal heart sounds is uniform as shown in Figure 2.

These facts have been accepted and standardized because in the mechanism of the cephalic and podalic position the fetal ovoid has been held to be in various attitudes of flexion except those that are known to be deflected such as brow or face.

In recent years roentgenography has come into use as a diagnostic aid in obstetrics. These roentgen studies may change our conceptions of the attitude of the fetus in utero during pregnancy and labor. Warckow has clearly demonstrated by serial roentgen pictures that in the last few months of pregnancy and during labor the attitude of the fetus is of varying degrees of deflexion in known proportions and presentations. Previous to the use of the roentgen ray many obstetricians by the usual means of abdominal palpation and rectal or vaginal touch mutually felt that the fetus was in some degree of deflexion in known position and attitude. This repeatedly observed in palpation of the fetus in utero late in pregnancy and during labor that in some cases the fetus is not as flexed as others has been in the same position and presentation.

In view of roentgenograms one sees many variations in the relation of the fetal spinal column to the maternal pelvic column and to the maternal sacrospinous synchondrosis. In cephalic positions the fetal spinal column may lie over the maternal pelvic column and then may be placed at first relatively laterally until it is found deep in the flank free from the maternal spinal column. If the fetal spine is





spontaneously and in a few minutes the perineum began to bulge. At 4:15 there was complete dilatation with the head on the perineum. The fetal heart sound was found on the lower right quadrant. Spontaneous delivery occurred at 4:45 p. m.

At about the thirty-sixth week of pregnancy a diagnosis was made of right occiput-anterior and the fetal heart sound were heard over the lower right and left quadrants of the abdomen. The fetal back did not appear to be deep in the flank. When the patient went into labor the diagnosis before roentgen examination was right occiput-anterior with some deflexion in a normal flexion attitude. No vaginal examinations were made throughout the labor by rectal examination the relation of the fontanelle could not be determined on account of the high head. After the roentgen picture was studied it felt that my diagnosis was confirmed.

In normal flexion attitude there are four types of variations in the fetal heart sound.

1. *Complete flexion* With the fetal back deep in the flank of the mother the heart sounds are heard only over the position of the back.

2. *First degree of deflexion* The fetal heart sounds are heard distinctly over the fetal back and faintly in the opposite quadrant or in relation to the fetal chest.

3. *Second degree of deflexion* The fetal heart sounds are heard over the lower right and left quadrants and are of equal intensity being in relation to the back and chest.

4. *Third degree of deflexion* The fetal heart sounds are faint over the fetal back and distinctly on the opposite quadrant or in relation to the fetal chest.

*Roentgen pelvica* A diagnosis is made of the position and presentation by palpation and auscultation of the fetal heart sounds in relation to the back and chest at the thirty-sixth week in the locations and the intensity are recorded. The fetal heart sound is systematically recorded until the end of labor. I have found cases in which the sound have passed progressively through the four stages enumerated. I believe it is possible to follow the complete flexion attitude to extremely deflexion (face) attitude by following the fetal heart sound progressively through the stages enumerated. Then finding the heart sound as present in the complete deflexion attitude.

*Roentgen pelvica* At the thirty-sixth week the sound are recorded only in relation to the back. On subsequent examination the sound is found in the same or in some type of flexion attitude. At the thirty-sixth week the sound are heard only in relation to the back deep in the flank according to the type of the deflexion variation. More frequently I have found double location of sound with varying degrees of intensity. During the pregnancy and labor the

intensity changes. In a few cases of left occiput presentations at the thirty-sixth week of pregnancy I found the fetal heart sound deep in the left flank. On subsequent examinations the fetal heart sounds were heard only in the right lower quadrant. These cases gave me grave concern because I feared right mento-anterior presentation. At delivery they proved to be occiput presentations.

*Persistent occiput presentation* When the fetal heart sound were heard only in relation to the chest the labor was protracted. In a few cases I found that during labor the sounds were heard faintly in relation to the back which was a good prognostic sign that flexion was taking place and that rotation would therefore be hastened.

*Transverse arrest* When the rotation of the head arrested in the transverse diameter and the sagittal suture palpated and the relation of the fontanelles determined I have found in most cases double location of the fetal heart sounds with varying degrees of intensity.

*Double presentations* are illustrated by the following as Mr. B. B. At the thirty-sixth week a diagnosis of acral left anterior was made. The fetal heart sound were heard only in the right lower quadrant of the abdomen. This location persisted through the pregnancy and labor. At delivery the presentation was acral left anterior with legs extended. The explanation for this location is that the placenta was implanted on the anterior surface of the uterus. If the placenta was large which would fill most of the back the fetal chest is displaced forward and outward in relation to the lower right anterior uterine wall and the heart sound were transmitted to the right side of the maternal abdomen.

## CONCLUSIONS

The fetal heart sounds are not transmitted only from the back or chest; other areas on the abdomen.

Roentgen sounds from the locations are transmitted to the abdomen at the same time by way of the back and chest.

3. Normal positions and presentations may have an asomestic slight deflexion of the fetal spinal column.

4. The interpretation of double location and intensity of the fetal heart sound is an aid in determining the cause in the delay in the progress of labor.

## DISCUSSION

DR. W. A. N. DORLAND: This paper is interesting to me especially because of the possibility of variation in the outline of the normal fetal ellipses during labor. The work of Warnekros has beautifully shown this variation in labor. Recently I had an X-ray taken of breech presentation at 8 months. It shows that the fetal ellipse is not fixed during pregnancy. It is easy to see from this picture how it might be difficult to hear the fetal heart sounds in flexion were complete.





forming the experiment at the same time of day with the same room temperature etc certain conclusions may be drawn

The apparatus and method we used for the estimation of viscosity was that of Heiss. We made at first a great number of estimations on the normal and not until we had the method mastered did we start our investigation. Peripheral blood was used. The coagulation time was estimated by the capillary pipette method and controlled by the slide method under the micro scope

Ancient physicians such as Galen claimed that the blood in pregnancy is thicker than normal. It is considerably richer in blood lipoids, cholesterol, cholesterol esters and lecithin and fatty acids and the globulins are considerably increased. In the later months of pregnancy we find a lower plasma bicarbonate level, a state of an uncompensated acidosis with increase of ketone bodies. The slight cyanosis present could be produced by an impediment to breathing through the large uterus—over carbonization of the blood—but may be an under saturation with oxygen produced by an abnormal great reduction of the blood oxygen during the passage through the placenta. If we consider then that at least in the later stages of pregnancy there is an over carbonization, the strongest factor in the increase of viscosity, if we consider the increased lipid kidney and liver disturbance, the retained nitrogen proteids and urea which are correct for a good many cases, then we should expect an increased viscosity in pregnancy.

The average viscosity finding of different authors as collected in the literature in 54 women 142 hile I found the average viscosities of 30 pregnant women to be 4.63 in the latter part of pregnancy. Case 24 shows the highest viscosity 6.7 a coagulation time of 1.50 and 1,100,000 platelets. Case 8 shows the lowest viscosity 2.2 a coagulation time of 5.10 and 170,000 platelets. The blood pressure was 90/70 the haemoglobin 69 and there were present oedema of the ankles and lower extremities and hydræmia which explained to some extent the low viscosity.

The low readings of viscosity were found in a woman pregnant 6 months a viscosity of 0.3 coagulation time 2.50 haemoglobin 0 and blood pressure 110/80. In another woman 3 months pregnant the viscosity read 2.75 coagulation time 4.0 haemoglobin 65 blood platelets 90,000. There was no history of severe hemorrhages and a possibility of a hydatid mole was considered. Thus the average viscosity in the later months of pregnancy is about 0.4 higher than normal.

Surprising are the findings in 15 women about the end of the first week after delivery. The average viscosity in spite of the removal of blood is very high 5.17. Case 9 7 days postpartum a viscosity of 7.10 a coagulation time of 1.0. All 5 women nursed their babies. The cause of this rather marked increase in viscosity must be looked for partly in the high viscosity of the maternal blood during the process of involution of the uterus and partly

in lactation. The blood platelets were counted in 10 women two of them in the second and third month of pregnancy, the rest toward the latter part of pregnancy. The average number of blood platelets in these 10 women was 392,000 the average in the normal women between 250,000 and 500,000. Case 4 shows a high count of 1,100,000 a coagulation time of only 1.50. In Case 46 no platelets could be seen either in the native or stained slide. Case 47 has a very low count of 90,000.

Concerning the correlation between coagulation time and viscosity it can be said that there seems to be in some cases a strict parallelism between them. Case 8 shows a viscosity of 7.1 and a coagulation time of 1.10. Case 4 a viscosity of 6.7 and a coagulation time of 1.35. Case 24 a viscosity of 6.7 and a coagulation time of 1.50 blood platelets 1,100,000. But this parallelism does not hold good all the way through my cases. Case 10 with a viscosity of 5.9 has a coagulation time of 3.15. Case 9 a viscosity of 5.8 and a coagulation time of 5.30. Case 7 a viscosity of 4.1 and a coagulation time of 6.10. On the other side low coagulation correlated to a high blood platelet count and vice versa. However the number of blood platelet counts is too small to allow definite conclusions. This much can be said.

The viscosity of the blood of pregnant women in the latter part of pregnancy is higher than in the non pregnant.

TABLE I — AVERAGE VISCOSITY

C	Viscosity	Coagulation time	Ag	Chills	Blood platelets
1	0th	4.5	3.5		
	7th	4.60	3.30	9	2nd
2	8th	4.85	3.3	32	3rd
3	4th	4.90	5.3	9	2d
5	9th	4.9	5	38	4th
6	4th	5.00	3.15	9	5th
	th	4.8	3.00	1	t
9	6th	4.4	4.0	34	2nd
9	6th	4.10	3.45		t
	th	5	4.00	2	1st
	5th	4	4.30	25	1st
	6th	4.4	5.0	0	1st
3	8th	4.70	3.30	32	3rd
4	th	4.5	4.0		t
5	th	4.5	4.15	36	st
	8th	4.0	3.45	2	2d
	6th	3.95	7.00	2	6th
5	7th	4.30	4.00	5	1st
10	6th	4.5	3.25	24	st
	7th	4.0	3.5	4	2d
2	6th	4.70	4.45		st
2	6th	3.75	4.30	9	1st
3	7th	4.30	5.00	23	rd
24	10th	6.70	1.50	4	4th
	5th		2.40		1,100,000
6	6th	5.45	4.30	26	3d
	3rd	4.0	6.0	36	8th
9	th	0	5.30		7,000
20	th	5.8		27	d
3	4th	4.0	3.45	29	3rd
3	d	9	5.0	6	st
3	3rd	2.75	4.20	18	t
					90,000

TABLE II—VISCOSITY ABOUT WEEK POSTPARTUM

C sec	Day post partum	Viscosity	Clot	Age	P
2	1st	4.8	3.6	39	4
3	oth	4.90	3.15		
3	3d	5	15	36	7
4	oth	6.7	1.35	19	1
5	3rd	4.45	6	19	
6	oth	5.50	25	8	2
7	6th	5	1.5	27	1
8	th	7.0	0		
9	1th	4.65	2	30	4
	th	5.90	3.5	29	
1	th	5	3	4	
1	7th	5.9	2	27	
3	9th	5	30	0	
4	5th	5.0	4.15	1	1
5	7th	4	3.15	24	

2 It is higher in the second week postpartum in the nursing mother

3 A parallelism between viscosity and coagulation is not apparent

### DISCUSSION

DR C. S. BACON. This is a very interesting study, but there is no attempt made to make use of this method for practical purposes. For that reason it is all the more interesting. We are generally looking for something that we can use. In the past attempts have been made to make practical use of the viscosity of the blood but these have failed. It does not follow that the attempts will always fail. My interest in the subject has been to find the relation between the increased viscosity of the blood and increased blood pressure. The relation between the coagulation time and the viscosity interesting and may have a bearing on the problem.

I am not for the purpose of adding anything to the discussion but I dislike to see a paper that is of

such interest as this allowed to pass without a word of comment.

DR C. F. IADDOCK. I agree with the last speaker. It is not right to let this paper go without comment. The essayist has not come to any definite conclusions but he shows a large amount of work which with further investigation may be of much value.

I would like to ask him if he came to any conclusions as to why the viscosity was higher in the second week of the puerperium than it was at the time of delivery.

DR J. P. CREENHILL. I would like to ask Dr Schiller whether any of his patients had toxemia and if so whether he found any change in the viscosity of the blood. We know that the blood of toxemic patients has a tendency to clot very rapidly and although Dr Schiller said there was no parallelism between blood clotting and viscosity still there may be a change in the viscosity of the blood of patients with toxemia due to factors other than abnormal clotting.

DR HELIODOR SCHILLER (closing the discussion). Several years ago in studying the blood chemistry of pregnant women I found cholesterol and cholesterol esters and lipoids very much increased toward the end of pregnancy. I thought this increase easily explained the increase in the viscosity of the blood of the pregnant. This increase of cholesterol and lipoids however disappears very soon after delivery and surely could not offer an explanation for the definite increase of the blood viscosity after delivery. The absorption of products produced by the involution of the uterus might explain it better. All conditions present after delivery would make us expect a fall in viscosity. I have no explanation to offer for the definite increase in the viscosity of the blood which takes place toward the end of the first week of pregnancy.

There was no case of toxemia among those investigated. All cases were normal.



# TRAITE DES HERNIES

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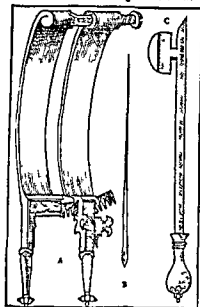
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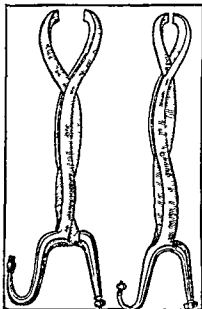
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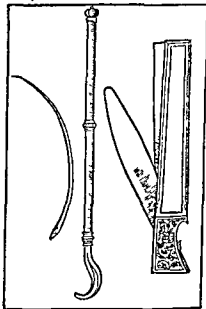
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# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN M.D. F.A.C.S. OMAHA, NEBRASKA

### THE SURGERY OF HERNIA BY PIERRE FRANCO

NOT very much is known of the life of this man Pierre Franco who was one of the most original surgeons of the sixteenth century. In his writings he gives a few facts and others have been gathered here and there. He was born in 1500 in the town of Turners in Provence a little west of the border of Switzerland. Of his early education we know only that he picked up his surgery from the itinerant herniotomists lithotomists and operators on cataract. These three operative practices he practiced throughout his life but brought them to a state of perfection far beyond that of his teachers and though he probably belonged to the class of itinerant surgeons in his early years eventually as his knowledge, experience and skill increased he came to distinguish this class of practitioner. His first book, *A little Treatise* containing one of the principal parts of surgery which surgeons call hernia, was published in 1556 while he was living and practicing in Switzerland and had been in the service of the government of Berne for ten years to which the government of Lausanne where he lived was subject. Why he left France for Switzerland is not known but as he was a Protestant it is reasonable to infer that it was due to religious difficulties and not from choice for in 1561 when his second book was published he found back in southern France again living and practicing in Orange where he remained until his death the exact date of which is not known.

Franco's second book was a great and a very his first effort and shows the improvement he had made and undergone in the ultimate experience and effort. That he studied anatomy is apparent not only from his work but also from the fact that he presented to the city of Bern a full and complete anatomical skeleton which had mounted himself. That he had a considerable knowledge is shown by his reference to the anatomy of the bones of the middle age and in this alone he had advanced far out of the class of his teachers. In this second publication he includes general surgery though the greatest stress is still upon herniotomy and lithotomy. It contains a full declaration of all their anatomy and other excellent parts of surgery that it is the stone of the cataract of the eye and the diseases of which the cure is dangerous and which

there are also few men well trained with their causes symptoms complications anatomy of the parts affected and their complete cure.

The volume is written in early French and the style is clear and the working concise. At times the spelling is a bit difficult but on the whole it is most interesting especially the portion on hernia. In the anatomy Franco pays all his attention to the hernial sac and its content and mentions entirely the influence of the muscular and upon urotic walls of the inguinal canal on the formation of hernia. He believed that in the majority of cases of complete hernia the peritoneum ruptured while in bubonocoele it is only stretched. He distinguishes between bubonocoele and scrotal hernia and also recognizes the difference between uterocoele and epiplocele. Likewise he shows the difference between incarcerated hernia in which the contents are adherent to the sac and strangulated hernia. In the former he gives detailed directions as to the dissection of the contents and in the latter he advises operation—he opens the neck of the sac from without through a high incision over the external ring. He first describes the usual operation of his time in which the testis and sac are removed en bloc by crushing the neck of the sac and cord and removing all material beyond the crushing clamp after which the stump is cauterized with the actual cautery. He advises the use of this procedure in case of unilateral hernia.

Later he describes his own operation in which he preserves the testis and this operation he advises in bilateral hernia. He also describes an operation in which he uses a golden wire to hold the hernia in place. In all cases he advises draining of the scrotum to its lowest point to ward against infection. Throughout the work he cites clinical cases to emphasize the exact point he is trying to make and everywhere his explanations are very clear and leave no doubt that the man is giving the results of his personal experience.

Though the treatise on hernia dominates the book it would be unfair not to call attention to the fact that Franco was probably the first surgeon to practice suprapubic lithotomy successfully where he used it in a child after failing to remove the stone by perineal section. He also improved the operation of perineal lithotomy by devising an itinerarium and stone forceps which were much better than any in use before his time.

## REVIEWS OF NEW BOOKS IN SURGERY



THE reaction of the reader to these interesting volumes<sup>1</sup> on the life of Oler will depend to a degree on his own memories of Oler or if he has been so fortunate on his personal acquaintance with him. For many a reader the remembrance of a certain occasion or address or meeting will bring back happy and moving recollections and for

those who were actors on the stage Cushing's Life will be a priceless treasure. To us of a younger generation who knew Oler as a figure that loomed large in the world of medicine but who were never so fortunate as to have seen or heard him Cushing's Life has more than conveyed something of his spirit as he has suggested in his dedication it has made Oler a vital personality that will continue through years to come to influence those who come in contact with him through the pages of these volumes.

It is not fitting to attempt here a portrait of the view of Oler's life. We wish rather to acknowledge our debt to the author for undertaking his arduous task and to express our admiration for the way in which he has accomplished it. He has let his story tell itself and has done it with the true art that conceals itself.

Cushing has produced for us an ineffaceable picture of an ideal physician—a man who was first of all a lover of his fellowmen. No one could have left a sleep and permanent impression on all with whom he came in contact unless he truly loved them. Dr. Francis suggested how fitting to him were Coleridge's lines:

He pities both the loveth both  
All thus both good and ill

Not a small part of his affection naturally is for those who loved him. The story of his home life is a volume in itself and the death of his son Reverie is touching beyond words.

Combined with this love for his fellow men the mind and outlook of the student and worker—a student who kept pace with changing developments in his changes of many and rapid a student in his story particularly of medical history a lover and collector of books a consistent worker who saw things largely and sanely who strove to set a standard of knowledge of the scientist into practical and effective

measures for improving public health. That he was a stimulating and beloved teacher and the author of a famous textbook is synonymous with the name of Oler.

We would wish for every medical student that at the beginning of his Freshman year he might read and possess Cushing's *Life of Oler*. We feel that he would not willingly part with it.

SUMNER L. KOCH

IMAGINE there were many of us who were unable to obtain a copy of the *Manual of Surgical Anatomy* which was prepared by these authors during the late war for the Medical Corps of the Army and Navy. Certainly the Surgeon General's office must have received many urgent and pleading requests from the unfortunates. How the possessors of that manual guarded it and kept it handy. With the publication of a revised and more complete civil edition such superiority of ownership exists no more.

This hand atlas of anatomy is in no sense a textbook but a portrayal of anatomy wholly by illustrations. These are concise in that they include the most practical applications of anatomy for clinical use. They are therefore invaluable to the surgeon and to the advanced medical student. Perhaps one of the most striking and valuable additions is that of the projection of the origins and insertions of the muscles upon the skeleton. This has always been difficult to visualize from a written text. A very complete explanatory index which works accurately and without waste of time is a feature.

No fortunate are less well endowed unless they put aside the old and get the new.

LOYAL D. VINT

TUMORS of the Spinal Cord by Dr. Elsberg. Fill a want in the literature of the surgery of spinal cord tumors. It does similarly constructed monograph which deals with various types of intracranial tumor. It is the record of the considerable personal experience of the author and stands as a worthy monument to his contributions to neurology and surgery. Books written in general terms concerning the surgery of the spinal cord are useful but they are general rather than both convincing and misleading. It is through the setting down of all material not so much replete with observations and the progress and termination of the case that we are able to realize the surgical problems which confront the surgeon. S. W. MA

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The Life of S. William Oler, M.D. By H. C. Cushing, M.D.  
New York: O. F. O'Leary Press, 1935.

add our own personal discussion to the facts given and thereby we have a volume which is stimulating instead of being pleasantly hypnotic.

Dr Elsberg has followed his study upon 81 verified spinal cord tumors by a discussion of the symptomatology produced by growths situated at the various levels, a description of the common pathological anatomy and a detailed description of the surgical procedure of laminectomy.

If this volume is read and studied carefully it can not fail to impress the reader with the number of cases of spinal cord tumors which are seen early in their course and are diagnosed so faultily. It will have the second value of pointing out the brilliancy in the results obtained by the early removal of spinal cord tumors.

LOYAL DAVIS

THE modern surgeon is ever becoming keener in his diagnostic acumen. The basis of this acumen is a thorough understanding of living pathology and its perverted physiology. A close study of many surgical schools will demonstrate that the surgeon who depends too much upon his pathological association for a diagnosis lacks surgical judgment and when deprived of the service of the pathologist faces in fact on which a potential menace to the life of his patient. This is not intended to belittle the services of the pathologist nor the aid that the well-trained pathologist may render the surgeon. In arriving at a clinical diagnosis the surgeon must know his living pathologist. In the operating room it is even more essential that he know pathology since the entire operative procedure will depend upon the pathological diagnosis.

In recent years works have appeared the purpose of which is to make available for the surgeon the study of living pathology. Not to omit much datum which might interest the student of pathology, but of immediate service to the surgeon. One of the most useful of such works is the volume by Lloyd. The author writes in his preface that he

not only writes on differential pathology, but also intends to incorporate in a single volume the facts which are useful to the surgeon in dealing with pathology. He has prudently included the symptoms of certain pathological processes because many in the clinic symptoms with their pathophysiological changes will add in the pathological diagnosis.

The reviewer has on numerous occasions referred to this volume during his report of time that has been devoted to the information of surgical teachers and for his help in his private work. Some criticism might be offered in that certain subjects such as gyrtic and duodenal and benign tumors of the breast are treated briefly, the outline.

The work treats of pathology only as related to surgical diseases and of course omits all purely medical conditions such as diseases of the heart and

lung. The text is well written and many original illustrations are incorporated. The book contains much information in readily available form and is exceedingly valuable to the student of surgery.

J. A. WOLFER

THE recent monograph by Beck<sup>2</sup> calls to our attention the importance of the human hand. No doubt all the organs of precision are invaluable to the functioning whole, yet the hand which is constantly in use which is continuously subjected to trauma and which is in the machine is kept from harm solely by a well-trained nervous mechanism, the most frequent sites of injury and infection and when deformed the resultant disability becomes a handicap which seriously menaces the working capacity of the average artisan be he a plumber or a surgeon.

The author displays imagination in his plastic work. The congenital deformities are well treated practically all of these are mentioned and their treatment illustrated and described. Pedicle flaps from the chest and abdominal wall are resorted to frequently. There is brevity and lack of fullness in the presentation of the anatomical and surgical aspect of the subject of infections of the hand as a cause of deformity. Curiosity is aroused for more information on the subject of tendons in the hand since this is a common deformity difficult to treat. It would seem to the reviewer that if the subject of infections and their treatment is considered it should be treated more thoroughly. The chief question but that here prophylaxis plays a greater rôle than plastic surgery.

The author has covered much of the subject in a very commendable manner, but this type of surgery is still in its infancy and it is to be hoped that the author will enlarge upon the subject as his experience advances.

J. A. WOLFER

A BRIEF manual of X-ray technique and interpretation for the student of medicine is most desirable. The student has neither the time nor the patience to read the numerous journal or the more exhaustive works on roentgenology consequently he should have available a brief work which he can consult. The reviewer knows of no work more concise and clear than the recent volume by Christ<sup>2</sup>. This work is not meant for the roentgenologist or the specialist in medicine but is written essentially for the student. The first portion of the volume is devoted to the general principles of electricity and magnetism, the roentgen ray and tube apparatus and the like. Roentgenographic and dark room techniques are briefly yet clearly described. Following this the author discusses the roentgenographic study of the various systems or regions of the body and their demonstrable pathology. Two

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5. 1. P. H. Wey. B. W. L. m. B. d. M.D. M.R.C.P. (Ed.)  
F.R.C. 1. lph. lph. 1. Lond. W. B. Saunders Co. mpa





## BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be registered as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

**SYMPTOMS OF VISCERAL DISEASE**—A Study of the Vegetative Nervous System in its Relationship to Clinical Medicine. By Francis Marion Pittenger. A.M. M.D. LL.D. F.A.C.P. 3d ed. St. Louis: The C.V. Mosby Co. 1925.<sup>4v</sup>

**SOME FUNDAMENTAL CONSIDERATIONS IN THE TREATMENT OF EMPYEMA THORACIS**. By Evaris A. Graham. A.B. M.D. St. Louis: The C.V. Mosby Co. 1925.

**DIE KLINIK DER BOESARTIGEN GESCHWÜLSTEN**. Edited by Geh. Rat I. f. Dr. P. Ziesenis and Geh. Med. Rat Prof. Dr. E. Payr. Vol. II. Leipzig: S. Hirsch. 1925.

**TRAITEMENT DU DIABÈTE**. By I. E. Escudé. Paris: A. Maloine & Fils. 1925.

**THE ICONOGRAPHY OF ANDREAS VESALIUS (ANDRÉ VÉSALE) 1514-1564**. By M. H. Spielmann. F.S.A. London: John B. Le Sons & Danielson Ltd. 1925.

**A MANUAL OF GYNECOLOGY**. By John Cooke Hirst. M.D. F.A.C.S. Philadelphia and London: W. B. Saunders Company. 1925.

**DIAGNOSTIK MIT FREIEM AUGES (OPHTHALMOSKOPIE)**. By Dr. Eduard Weisz. Berlin and Vienna: Urban & Schwarzenberg. 1925.

**BIOLOGIE UND PATHOLOGIE DES WEIBES**. In Handbuch der Frauenheilkunde und Geburtshilfe. Edited by Josef H. Lössner and Ludwig Stetz. Leipzig: Urban & Schwarzenberg. 1925.

**THE SURGERY OF PULMONARY TUBERCULOSIS**. By John Alexander. B.S. M.A. M.D. Philadelphia and New York: Lea & Febiger. 1925.

**DIE FRUCHTABTREIBUNG ALS VOLKSKRAFT**. By GE-

FAHREN. URSACHEN. BEFÄHMPL. G. im Auftrag des deutschen Aerztevereins. By San. Rat Dr. Vollmann. Leipzig: Georg Thieme. 1925.

**THE OPHTHALMIC YEAR BOOK**. Vol. XV. Edited by William H. Cn. Chicago: Ophthalmic Publishing Company. 1925.

**CANCRO DO ÚTERO**. Apontamentos para o Estudo e Regimento da sua Profilaxia. By Jorge Monjardino. Rio de Janeiro: Luminosa de Mello & C. 1925.

**TEXTBOOK OF ORTHOPEDIC SURGERY** for Students of Medicine. By James Warren Sever. M.D. New York: The Macmillan Company. 1925.

**SURGICAL TREATMENT OF PULMONARY AND PLEURAL TUBERCULOSIS**. By J. Graesslin. M.D. with a foreword by S. V. Peterson. M.D. M.R.C.P. New York: William Wood & Co. 1925.

**CANCER—Post Graduate Lectures**. Delivered under the auspices of the Fellowship of Medicine. Edited by Herbert J. Peterson. With a preface by Sir John Blund Sutton. LL.D. F.R.C.S. New York: William Wood & Co. 1925.

**MODERN OPERATIVE SURGERY**. Edited by H. W. Carson. F.I.C.S. (Eng.) Vols. I and II. New York: William Wood & Company. 1925.

**ALLERGY**. Asthma, Hay Fever, Urticaria and Allied Manifestations of Reaction. By William W. Duke. Ithaca, N.Y.: C.V. Mosby Co. 1925.

**OPERATORIA UROLÓGICA**. By D. Manuel Serís. Barcelona: J. B. Aragó. 1925.

**ACTAS Y TRABAJOS TRANSACTIONS OF THE SECOND NATIONAL CONGRESS OF MEDICINE ARGENTINA**. Vol. I—Urological Section. By Hydatius Benos. Aires: I. Spinelli. 1925.

**GYNECOLOGIC UROLOGY**. By Lynn Lyle Fikerson. A.B. M.D. F.A.C.S. Philadelphia: P. Blakiston's Sons & Co. 1925.

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

CHARLES H MAYO Rochester *President*

RUDOLPH MATAS New Orleans *President Elect*

FRANKLIN H MARTIN Chicago *Director General*

## PHILADELPHIA COMMITTEE ON ARRANGEMENTS

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J D ELLIOTT

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WILLIAM B SWARTLEY

WILLIAM BATES

ARTHUR HARTLEY

PAUL M MEGRAY

T TURNER THOMAS

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J L VAN TINE

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JOHN H JORSON

W E PARKE

J RALSTON WELLS

G M DORRANCE

A J KFEODAN

D B IFFIFFER

A D WHITING

F I ELIA ON

FLOYD E KEFNE

## PROGRAM FOR THE CLINICAL CONGRESS IN PHILADELPHIA

THE fifteenth annual Clinical Congress of the American College of Surgeons will open at 10 o'clock on Monday morning October 26 at the Bellevue Stratford Hotel in Philadelphia with the annual hospital conference. At the presidential meeting on Monday evening the first formal session of the Congress the President Elect Dr Rudolph Matas of New Orleans will be inaugurated succeeding Dr Charles H Mayo in that office. The John B Murphy oration in surgery will be delivered at that session by Sir William Arbuthnot Lane of London England.

Clinics and demonstrations at the hospitals and medical schools will provide an interesting program for the mornings and afternoons of the four days Tuesday to Friday inclusive with scientific sessions each evening. For these evening sessions the Executive Committee of the Congress has provided programs of unusual interest. A complete program for the evening sessions will be found in the following pages. At the convocation of the College on Friday evening the Fellowship

Address will be given by Lord Dawson of London England physician to King George.

The Committee on Arrangement of which Dr Charles F Nassau is Chairman and Dr Warren B Davis Secretary has prepared a program of clinics and demonstrations that will surpass in scientific interest all previous sessions. The preliminary clinical program is being reprinted in this issue. This program will be revised and amplified previous to the meeting so that the actual program will fully represent the clinical activities in all departments of surgery. The real program of the Congress is to be issued daily during the session giving in complete detail a description of the clinics and demonstrations at the several hospitals and medical schools. This program will be issued in the form of bulletins posted each afternoon at headquarters for the following day's clinics. A printed program will be issued each morning.

An important feature of the program will be a series of clinical demonstrations or dry

clinics at a number of the hospitals in which surgeons internists pathologists roentgenologists and other specialists will participate to discuss some of the more important phases of surgery.

Of special interest to those engaged in the practice of ophthalmology and otolaryngology is the program of papers and demonstrations prepared by the Committee to be given in the Ball room on Wednesday Thursday and Friday mornings at nine o'clock supplementing the clinical work in the hospitals in the afternoon.

General headquarters of the Congress will be established at the Bellevue Stratford Hotel Broad and Walnut streets where the entire first floor including the Ballroom Clover Red Pink and Gold rooms together with the Stratford Poom on the main floor and the Rose Garden and other rooms on the roof have been reserved for the exclusive use of the Congress. These rooms provide ample space for evening meetings business sessions hospital standardization headquarters registration and ticket bureaus bulletin rooms etc. Headquarters will be open for registration at eight o'clock on Monday October 26.

The clinical program for Tuesday will be posted on bulletin boards at headquarters during Monday afternoon and reservations for tickets for Tuesday's clinics may be filed late that afternoon.

The annual meeting of the Fellows of the College will be held in the Ballroom of the Bellevue Stratford on Thursday afternoon at three o'clock to be followed by the annual meeting of the Board of Governors.

Since the last session of the Congress in Philadelphia in 1921 there have been erected in that city a number of fine large hotels situated within easy walking distance of the Bellevue Stratford so that the hotel situation in that city has been greatly improved. A list of the Philadelphia hotels recommended by the Local Committee on Arrangements together with the rates will be found on another page.

#### HOSPITAL CONFERENCE

The preliminary program for the annual hospital conference to be held on Monday Tuesday and Wednesday both mornings and afternoons at the Bellevue Stratford will be found in the pages following. Addresses demonstrations round table conferences and general discussion by surgeons superintendents trustees nurses and others interested in the conduct of hospitals deal intimately with the details of hospital standardization and management providing a program of very great interest and

practical value in treating many of the everyday problems and difficulties encountered in hospital management and the care of the patient within the hospital.

At the opening session on Monday morning Dr. Franklin H. Martin, Director General, will present his report including a list of the hospitals which appear on the approved list for the year 1925.

A hospital information and service bureau in charge of Dr. M. T. MacEachern, Associate Director in charge of hospital standardization activities, will be maintained in the Congress headquarters throughout the session to give assistance to any hospital seeking solutions of its troublesome problems. All who are particularly interested in hospital problems are requested to register at hospital standardization headquarters upon arrival at Philadelphia. A general invitation is extended to hospital trustees members of the medical and surgical staff and hospital personnel generally to attend the conference.

#### REDUCED RAILWAY FARES

The railways of the United States and Canada have authorized reduced fares on account of the Philadelphia session of the Clinical Congress so that the total fare for the round trip will be one and one half the ordinary first class one way fare. To take advantage of the reduced rates it is necessary to pay the full one way fare to Philadelphia procuring from the ticket agent a convention certificate when purchasing such ticket which certificate is to be deposited at headquarters for the use of the special agent of the railway companies. Upon presentation of the certificate to the ticket agent in Philadelphia not later than November 3 a ticket for the return journey by the same route as traveled to Philadelphia may be purchased at one half the regular one way fare.

In the eastern central and southern states and eastern provinces of Canada tickets may be purchased between October 22 and 28 in southwestern and western states between October 21 and 27 and in the far western states and western provinces of Canada between October 16 and 22. The return journey from Philadelphia must be begun not later than November 3.

The reduction in fares does not apply to Pullman fares nor to excess fares charged for passage on certain trains. Local railroad ticket agents will supply detailed information with regard to rates routes etc. Stop-overs on both the going and return journeys may be had within certain limits.

Full fare must be paid from starting point to Philadelphia and it is essential that a convention certificate be obtained from the agent from whom the ticket is purchased. These certificates are to be signed by the general manager of the Clinical Congress and viséed by a special agent of the railroads in Philadelphia during the meeting. No reduction in railroad fares can be secured except in compliance with the regulations outlined and within the dates specified. It is important to note that the return trip must be made by the same route as used to Philadelphia and that the certificate must be presented and return ticket purchased not later than November 3.

#### SPECIAL TRAIN FROM CHICAGO

For the convenience of Fellows residing in the central and western states who will attend the meeting in Philadelphia the Pennsylvania Railroad will undertake to provide a special train leaving Chicago at 7:15 p.m. on Sunday October 25 arriving in Philadelphia at 9 a.m. on Monday October 26. This special train will duplicate the equipment and schedule of the famous Broadway Limited including standard Pullman sleeping compartment club observation and dining cars. The arrangement is contingent upon reservations for such special train being made by the minimum number required by the Interstate Commerce Commission rules. No extra fare will be charged for passage on this special train. Members are urged to make their reservations for the special train at the earliest possible date.

#### LIMITED ATTENDANCE

Attendance at the Philadelphia session will be limited to a number that can be comfortably accommodated at the clinics. The limit of attendance being based upon the result of a survey of the amphitheatres, operating rooms and laboratories in the hospitals and medical schools as to their capacity for accommodating visitors. This plan necessitates registration in advance on the part of all who wish to attend. When the limit of attendance has been reached through advance registration no further applications can be accepted.

#### CLINIC TICKETS

Attendance at clinics and demonstrations will be controlled by means of special clinic tickets which plan has proved an efficient means in the past for providing for the distribution of visiting surgeons among the several clinics and insures against overcrowding as the number of tickets issued for any clinic is limited to the capacity of the room in which that clinic is given.

Clinic tickets will be issued at headquarters each morning at eight o'clock for the clinics and demonstrations to be given that day. Each afternoon a complete schedule of the following day's clinics will be posted on bulletin boards at headquarters. After the program has been posted reservations for clinic tickets may be filed. The tickets to be issued the following morning.

#### REGISTRATION FEE

A registration fee of \$5.00 is required of each surgeon attending the annual clinical meeting. Such fees providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued which receipt is to be exchanged for a general admission card upon his registration at headquarters during the meeting. This card which is nontransferable must be presented to secure clinic tickets and admission to the evening meetings.

#### PHILADELPHIA HOTELS AND THEIR RATES

	Minimum Rate for Rooms with Bath	
	Single	Double
Adelphia Ch. 14th and 13th Sts.	\$4.00	\$8.00
Bellvue Stratford Broad and Walnut Sts.	5.00	8.00
Bejamin Franklin Chestnut and 9th Sts.	3.00	6.00
Green 8th and Chestnut St.	3.50	5.00
Loftis W. 14th and Walnut Sts.	4.00	6.00
Loftis Broad and Franklin Ave.	2.50	5.00
Majestic Broad and Arch Sts.	4.00	5.00
Robert Morris 17th and Arch Sts.	3.00	5.00
Pennsylvania Ch. 14th and 13th Sts.	3.00	5.00
Rittenhouse Chestnut and 2nd Sts.	3.50	5.00
Ritz Carlton Broad and Walnut Sts.	6.00	10.00
Spruce (men only) Spruce and 13th Sts.	4.00	
St. James Walnut and 13th Sts.	3.50	5.00
St. James Broad and Spruce Sts.	5.00	7.00
Sylvania Locust and 13th Sts.	4.00	6.00
Walters Broad and Locust St.	3.00	5.00

## PROGRAM FOR EVENING MEETINGS

IN THE BALLROOM OF THE BELLEVUE STRATFORD AT 8 O'CLOCK

*Presidential Meeting—Monday October 26*

- Address of Welcome CHARLES F. ASSAU M.D. Chairman of Committee on Arrangements  
 Address of Retiring President The Function of the Liver CHARLES H. MAYO M.D. Rochester  
 Introduction of Foreign Guests  
 Inaugural Address Personal Experience in the Surgical Cure of Aneurism (illustrated by motion pictures)  
 RUDOLPH MATAS M.D. New Orleans  
 The Doctor John B. Murphy Oration in Surgery A Tribute to Doctor Murphy SIR WILLIAM ARBUTHNOT  
 LANE Bt London England

*Tuesday October 27*

- CHEVALIER JACKSON M.D. Philadelphia Pulmonary Suppuration Due to Foreign Body Contrasted  
 with that of Other Etiology (Chalk and lantern demonstration)  
 VICTOR FAUCHET M.D. Paris France Experiences in the Surgical Treatment of Gastric Duodenal and  
 Jejunal Ulcers  
 Discussion JOHN H. GIBSON M.D. Philadelphia  
 A. MURAT WILLIS M.D. Richmond Virginia The Mortality in Important Surgical Diseases Especially  
 Appendicitis  
 Discussion DAMON B. PFEIFFER M.D. and JOHN STEWART RODMAN M.D. Philadelphia  
 PROFESSOR VITTORIO PUTTI Bologna Italy Congenital Dislocation of the Hip  
 Discussion ARTHUR BRUCE GILL M.D. and DEFOREST WILLARD M.D. Philadelphia

*Wednesday October 28*

- ARTHUR H. CURTIS M.D. Chicago Chronic Pelvic Infections Deductions Resultant from a Combined  
 Clinical and Laboratory Study  
 Discussion CHARLES C. NORRIS M.D. and P. BROOKE BLAND M.D. Philadelphia  
 W. BLAIR BELL B.S. M.D. Liverpool England The Treatment of Chronic Ascending Infections of the  
 Uterus and Adnexa by the Bell Beuttner Operation with Ovarian Conservation or Grafting  
 Discussion JOHN G. CLARK M.D. and BROOKE M. ANSPACH M.D. Philadelphia  
 ROBERT C. COFFEY M.D. Portland Oregon The Principles of the Radical Treatment of Cancer of the  
 Organs Located in the Pelvis  
 Discussion JOHN B. DEEVER M.D. Philadelphia

*Thursday October 29*

- Symposium on the Rehabilitation of the Handicapped Surgical Patient  
 Patients Suffering from Lesions of the Stomach and Duodenum GEORGE B. EUSTERYMAN M.D.  
 and DONALD C. BALFOUR M.D. Rochester Minnesota  
 Patients Suffering from Goiter ROBERT S. DINSMORE M.D. Cleveland  
 Cardiorenal Cases FRANK H. LAHEY M.D. Boston  
 Patients Suffering from Urinary Obstruction HERMON C. BUMPUS M.D. VERNE C. HUNT M.D.  
 and WALTER WALTERS M.D. Rochester Minnesota  
 The Use of Insulin in Surgery and Obstetrics F. N. G. STARR M.D. Toronto Ontario  
 Discussion FREDERICK G. BANTING M.D. Toronto Ontario  
 General Discussion GEORGE P. MULLER M.D. and JOHN H. JOYSON M.D. Philadelphia

*Contocation—Friday October 30*

Invocation

Conferring of Honorary Fellowships

Presentation of Candidates for Fellowship

Presidential Address RUDOLPH MATAS M.D. New Orleans

Fellowship Address THE RIGHT HON. LORD DAWSON OF PENNY GCHV KCMG CB M.D.  
 London England Physician in Ordinary to H.M. the King

## HOSPITAL STANDARDIZATION CONFERENCE

IN THE BALLROOM OF THE BELLEVUE STRATFORD

*Monday October 26—Morning Session 10 00 to 12 30*

CHARLES H MAYO M D Rochester President Presiding

Opening Address by the President

Presentation of the Eighth Annual Report of Hospital Standardization FRANKLIN H MARTIN M D  
Chicago Director General American College of SurgeonsThe Responsibility of the Fellows of the American College of Surgeons in Hospital Standardization LEROY  
LONG M D Oklahoma City Okla Dean and Professor of Surgery University of Oklahoma School  
of MedicineThe Hospital the Doctor and the Nurse as Co-operating Factors in the Care of the Patient W T HENDER  
SON M D Mobile Ala Visiting Surgeon Providence Infirmary and Mobile City Hospital

The Eminent Hospital RLY C B MOULINIER S J Milwaukee President Catholic Hospital Association

What the American College of Surgeons Can Do for the Smaller Hospital PAUL H FESLER Oklahoma  
City Okla Superintendent State University HospitalHospital Efficiency from the Viewpoint of the Internist ALFRED T STENGEL M D Philadelphia Pro  
fessor of Medicine University of Pennsylvania President American College of PhysiciansPolitical Interference in Hospitals RUDOLPH MATAS M D New Orleans Professor of Surgery Tulane  
University of Louisiana School of Medicine President Elect American College of Surgeons*Afternoon Session 00 to 5 00*The Hospital of the Future NEWTON E DAVIS Chicago President American Protestant Hospital Asso  
ciation Corresponding Secretary Board of Hospitals Homes and Deaconess Work of the Methodist  
Episcopal ChurchThe Application of American College of Surgeons Standards in the Modern Hospital H L FOSS M D  
Danville Pa Surgeon in Chief Geisinger Memorial HospitalEssentials for an Efficient Fracture Service in a Hospital CHARLES L SCLODDER M D Boston Consulting  
Surgeon Massachusetts General HospitalEnd Results and Follow Up HENRY L PAGE M D Philadelphia Medical Director Lankenau Hospital  
and Miss ANNIE M JASTROW Philadelphia Record Librarian Lankenau Hospital

Postmortems in Hospitals

Findings in the State of Pennsylvania Survey FRANK C HAMMOND M D Philadelphia Dean and  
Professor of Gynecology Temple University Department of MedicineRelation of the Surgeon to Postmortems CHARLES BAGLEY JR M D Baltimore Associate in Ex  
perimental Neurology Johns Hopkins University Medical DepartmentPostmortems in the Open Hospital ISRAEL BROWN M D Norfolk Va Surgeon St Vincent's  
Hospital and Sanitarium

General discussion

*Tuesday October 27—Morning Session 10 00 to 12 30*Group Conference on Medical Service in Hospitals—Ophthalmology and Otolaryngology JAMES A  
BABBITT M D Philadelphia Associate Professor of Otolaryngology University of Pennsylvania  
Graduate School of Medicine presiding Topics for discussion Minimum requirements for ophthal  
mological and otolaryngological departments in general hospital Need for ophthalmological and oto  
laryngological departments in general hospitals in a community where there is no special hospital for  
the purpose Special physical features to be considered in planning the department accommodations

for patients room wards etc examination treatment and operating rooms Standardization of equipment supplies and procedures Organization of the department relation to general organization medical and nursing Relation to allied services—clinical laboratory X ray anæsthesia requisitioning for clinical laboratory and X ray service routine clinical laboratory pre anæsthesia and pre operative examination special X ray technique required Case recording forms used content of records filing of records supervising of records filing and cross indexing of records use of record

General discussion

*Afternoon Session 10 00 to 5 00*

The Rôl of the Medical Staff in Hospital Efficiency J GARIAND SHERRILL M D Louisville Professor of Surgery University of Louisville Medical Department

Round Table Conference Conducted by JOSEPH C DOANE M D Philadelphia Medical Director and Superintendent Philadelphia General Hospital Topics for discussion The relation and responsibility of the hospital administration in pre operative preparatory procedure the relations and responsibilities of the interne the best methods of making more efficient the instruction and experience of the internes and nurses in the surgical department responsibility of the surgeon in promoting economies in the surgical department the most efficient arrangement of concurrent staff services in relation to duty the essentials for an efficient anæsthesia department supervision and control of the surgical department the open hospital policy the best means for handling extra charges for special services the education of new trustees in regard to the hospital and its workings

General discussion

*Wednesday October 8—Morning Session 10 00 to 1 30*

Group Conference on Medical Service in Hospitals—Internal Medicine ALFRED T STENGEL M D Philadelphia Professor of Medicine in University of Pennsylvania President of American College of Physicians presiding

*Afternoon Session—10 00 to 5 00*

Systematic Collection and Official Publication of Operative Mortalities as a Means of Fostering Surgical Accountancy ROBERT L DICKINSON M D New York Senior Gynecologist and Obstetrician to Brooklyn Hospital

Round Table Conference Conducted by JOHN D SPELMAN M D New Orleans Superintendent of Touro Infirmary Topics for discussion A plan of procedure in selecting members of the medical staff and extending privileges to doctors to practice therein the ownership of the case record the best means of improving the quality of case record the relation of medical staff to board of trustees the hospital and the private duty nurse the relative advantages and disadvantages of continuous versus divided ward services in a hospital dental service in hospitals isolation segregation and observation accommodations in all hospitals the problem of the tuberculous patient in the general hospital physiotherapy in hospitals

General discussion



# GENERAL SURGERY, GYNECOLOGY OBSTETRICS ORTHOPEDICS UROLOGY

## RESBYTERRIAN HOSPITAL

*Tu day*

JOHN H. JOHNSON and DAMON B. PREIFFER—9 Gen. ral surgery

FRANK C. KNOWLES and HENRY G. MONSON—1 Derm. tological clinic

JOHN H. GIBBY, GEORGE M. LAWS and PHILIP I. WILLIAMS—1 30 Gynec. logical clinic pathologi al. hilit a d d monstrati n f routine wo k in gynec. logical d spe. sary

W. S. NEWCOMET—2 30 Roentgenology

*W d n d y*

J. STEWART RODMAN and HENRY P. BROWN—9 General surgery

B. A. THOMAS and F. G. HARRISON—2 D monstrati n f c l ct a d equipment f g nito-urinary d lpe sary

W. S. NEWCOMET—3 Roentgenology

B. A. THOMAS, JOSEPH C. BIRDSALL and I. G. HARRISON—3 Genito-urinary clinic

*Thu d*

JOHN SPRESE and W. I. CHRISTIE—9 Gen. l surgery

JOHN TIMAN and W. F. CHRISTIE—2 Demonstration in surgical pathol. gy

W. S. NEWCOMET—2 30 Roentgenology

*F d y*

JOHN H. JOHNSON and DAMON B. PREIFFER—9 General surgery

W. S. NEWCOMET—2 3 Roentgenology

## HOWARD HOSPITAL

*T d y*

E. L. ELIASO, DRURY HINTON and V. W. M. WRIGHT—10 General surgical clinic i d strial surgery outl n of ec rd system foll p r ut urgency

*W d n d y*

B. C. HIRST—9 Gynecological clinic

*Th r day*

E. L. ELIASO, DRURY HINTON and V. W. M. WRIGHT—10 Fract. lnic methods a d r sults routine surgery u d r local anesthetics

S. W. MOOREHEAD—4 Gen. to-urinary lnic demonstration f s of local anesthetics in urol gy

*F d y*

B. C. HIRST—9 Gynec. l g cal clinic

## FRANKFORD HOSPITAL

*W d n d y*

W. E. PARKE—9 30 Plastics pl stic and retrovers n of uterus

E. A. SCHUMANN—9 3 F bro d of teru rcinom of t rus pl st and ectio

G. C. HANN—9 3 Cas r section

F. E. KELLER—9 30 Ca strian secti loc l nsth ia.

*Th d y*

CHARLES F. NASS—9 30 Ch l l thiasis duodenal l phroliths s s g t r

LOUIS D. ENGLISH—9 30 H m derlocal anesthetics fract re clinic

## PENNSYLVANIA HOSPITAL

*T d y*

HENRY B. BROWN and EDWARD STRECKER—9 Dry clinic. The surgical a d neurolog cal a pects of fracture of th skull

GEORGE NORRIS and staff—10 Med cal a pects nd diag no. of the ca es to be perat d upon

CHARLES F. MITCHELL, WALTER ESTELL LEE and HENRY B. BROWN—1 Gen. ral surgical operati ns

*W d n d y*

LEON HERMAN—9 Dry clinic G n to-urinary cases

GEORGE NORRIS and staff—10 Med cal a pects and di g nos s f cas s t be operated upon

JOHN H. CIBBO, ARTHUR L. BILLINGS and EDWARD J. KLOPF—11 Gen. ral urgical operati ns

*Th d y*

JAMES CAMERON—9 Dry cl c Oral rgical cases

Staff—o Demonstration of the s rgical path l gy of t ues remo d at peration in th surgical clinics on the two previous d y

EDWARD F. DILLON—11 Care of d betics before d after surg cal procedure

W. D. STROUD—1 H rt d s se in relati t s rgical perati n

CHARLES F. MITCHELL, WALTER ESTELL LEE and HENRY B. BROWN—1 Gen. ral surgical clinic

## EPISCOPAL HOSPITAL

*T d y*

RALPH S. BROWNE—9 X y d m strati

LOUIS H. MITSCHLER—11 G ralsurg ry

*W d n d y*

ASTLEY P. C. ASHURST, IRVING M. BOYKIN and EDWARD

T. CROSSAN—9 C rlsurg ry

A. BRUCE (ILL. R. L. J. HEN) and A. F. MOORE—Orthopedics

*Th d y*

E. C. ALEXANDER—9 General surgery

H. C. DEAYER—11 Gen. l surgery

*Friday*

E. T. CROSSAN—9 D m str t ns s rgical pathology

L. H. MITSCHLER—1 Ce ralsurg ry

JOHN B. HAINES—2 Cystoscopy clinic

## POLYCLINIC HOSPITAL

*Tue day*

DEFOREST F. WILLARD—1 3 O thoped cs

G. E. PFANHLER—2 Rad logi c nference

B. A. THOMAS—2 U l gy

*W d n d y*

W. G. ELMER—1 30 O th p d cs

*Th d y*

C. LILIER F. MARTIN—Proctology

J. F. SCHAMBERG—Arspen min clinic.

*F d y*

R. H. IVY—9 Pla ti s rg ry f th e ce

B. A. THOMAS—Urol gy

E. A. CASE—Surgic l p thology

## JEFFERSON HOSPITAL

Tuesday

J TORRANCE RUGH—9 30 Orthopedics  
CHARLES F NASSAU—11 General surgery  
THOMAS C STELLWAGEN—11 Gen to-urinary surgery  
JOHN H. GIBBON—2 Gen ral surgery

Wed day

CHEVALIER JACKSON—9 Bronchoscopy for diagnosis and treatment of diseases of the lungs  
BROOKE M ANSPACH—nd staff—9 Gynecology  
P BROOKE BLAND—9 Gynecology  
W H KINNEY—11 G ito-urinary surgery  
JOHN B FLICK—11 General surgery  
J CHALMERS DaCOSTA—2 Surg cal clinic

Th sd y

H R LOUX—9 Gen to-urinary surgery  
J M FISHER—1 Gynecology  
THOMAS A. SHALLOW—11 General surgery  
ARTHUR DAVIDSON—11 Orthopedic surgery  
CHEVALIER JACKSON, GABRIEL PECKER and LOUIS CLERF—12 30 Bro chocscop c asp rati n in suppurati e d seases of the lung

Friday

EDWARD J KLOPP—11 Gen er l su gery

## ST MARY'S HOSPITAL

T day

JAMES A KELLY—9 General surgery  
WILLIAM J RYAN—9 Gen ral surgery  
WILBUR H HAINES—4 d L F MILLIKEN—2 Genito-urn ry clinic

W T REES Laboratory dem stration

Wednesday

WILLIAM A STEEL—9 Abd min l surgery with spin l ansthesia.  
A P KEEGAN—9 Ge eral surg ry a d local anasthesia.  
C HOWARD MOORE—2 Orthopedic cl n c operat s an l d m strati n f c ses

W T REES Laboratory dem stration

Th d y

FRANK D HARRIS—9 Gynecology  
WILLIAM F MORRIS—9 Gynecology  
WILLIAM E PARKE—nd J STUART LAWRENCE—1 30 Obstet cal clinic l bor room and ward walks Oper at on. Pre tal cl c  
W T REES Laborat ry demo stration

## SAMARITAN HOSPITAL

T esday

JOHN LEEDOM J O BOWER G MASON ASTLEY JOHN C FRICK and J N COOMBS—9 Surg l clinic  
HARRY HUDSON—Orthopedic clinic.  
ALBERT STRICKLER—3 D rmat logy

Wed day

W WAYNE BARCOCK—9 Ge rals rgery  
CHARLES S. BAR 75 and C M STIMSO—11 Oostetrick.  
FRA E C HAMMOND—2 Gynecology  
W HERSHBY THOM S—4 Ge ito- urinary surgery  
HARRY Z. HINSHMAN—5 Keet l hric

Thursday

A. C. APPLEGATE—11 Ous trics.

Fri d y

W WAYNE BARCOCK—9 General surgery

## MISERICORDIA HOSPITAL

Tuesday

BASIL BELTRAN and staff—9 Gen ral surgery  
JAMES A KELLY and staff—9 General surgery

W d sd y

GEORGE P MULLER and THOMAS RYAN—9 General surgery  
J F V J NES A E BURKE and J J CANCELMO—2 Gen er l surgical cl c Buerger's d sease a cas of t t s osteomy litis foll wing a compound fracture of the pub c bone

Th d y

B SIL BELTRAN d staff—9 C nerals rgery  
JAMES A KELLY and staff—9 Ge er l urg ry

F d y

GEORGE P MULLER a d THOMAS RYAN—9 General surgery  
J F S J YS A F BURKE and J J CANCELMO—2 G n ral s rg l clinic acut osteomyelitis f tibia repair of perineal la rati n b m opl sty with local anasth s

## ST AGNES HOSPITAL

Tuesday

F C MURPHY—9 Dry cl Fat liti n of fracture cases th end re lts by perati e nd non-operati e p oced es.

JOHN I N JOES—9 C rals rg ry operat e clin c.  
JOHN A McCL L—9 C y eol gy E hibiti n of pat ents tre t d f r acut infl matory d sease by mea s f specific proteins Demonstrati n of m thod of tre tim t of go rthra in the f m le by heat.

W d d y

G M DORR CE n l J W BRANSTFIELD—9 Oper t e lum nd d m strati n f c ses. Cl ft pal te cases operated n by the new method l gation of pal te.

JOHN M FISHER—9 C y eol lory  
WILBUR H HALTS—2 Gen to- r nary surgery  
J C HIRST d staff—2 Cynec logy and obst trics

## MEDICO CHIRURGICAL HOSPITAL

T day

J B C ARNETT—9 Gen rals rg ry  
GEORGE M BOYD—1 Gynecology

W d sd y

GEORGE W OUTERBRIDGE—9 Cystoscopy  
WILLIAM R. NICHOLSON—9 Gynec logy

F w y

J B CAR NETT—9 Gen rals rgery  
GEORGE M BOYD—11 Gynecology

## NORTHEASTERN HOSPITAL

Wed sd y

H Z. HINSHMAN—9 Anorect l infections  
T TURNER THOMAS—10 Gen r ls rern  
JOHN B LOWNLS nd J A BROADFIELD—3 Operati and cystoscopy cl c

Th sd y

T TURNER THOMAS—2 Dry clinic Results with non operati reductio especially of whist low aboul d r h m and krl Operati reductio Compound fract res. Recurrent d llic tions of uou er Dra chial birth pal y

## UNIVERSITY HOSPITAL

Tuesday

JOHN G CLARK C C NORRIS and F E KEENE—9  
Gynecology  
C H FRAZIER F GRANT and TEMPLE LAY—9 Neuro-  
surgery  
B C HIRST E B PIPER J C HIRST H J K JAFFE  
G V JANVIER and W BENSON HARER—9 Obstetrics  
and gynecology  
GEORGE I MULLER and I S RAYN—9 General surgery  
A BRUCE GILL—9 Orthopedics  
CHEVALIER JACKSON and CARRIEL TUCKER—3 Broncho-  
scopy

Wednesday

JOHN G CLARK C C NORRIS and F E KEENE—9  
Gynecology  
E L LILSON and DRURY HINTON—9 General surgery  
A RANDALL S W MORRIS and P S FLOUZE and  
MAURICE MISCRA—2 Urology

Thursday

JOHN G CLARK C C NORRIS and F E KEENE—9  
Gynecology  
C H FRAZIER F GRANT and TEMPLE LAY—9 Neuro-  
surgery  
B C HIRST E B PIPER J C HIRST H J K JAFFE  
G V JANVIER and W BENSON HARER—9 Obstetrics and  
gynecology  
G P MULLER and I S RAYN—9 General surgery  
A BRUCE GILL—9 Orthopedics  
CHEVALIER JACKSON and CARRIEL TUCKER—3 Broncho-  
scopy

Friday

JOHN G CLARK C C NORRIS and F E KEENE—9  
Gynecology  
C H FRAZIER F GRANT and TEMPLE LAY—9 Neuro-  
surgery  
B C HIRST E B PIPER J C HIRST H J K JAFFE  
G V JANVIER and W BENSON HARER—9 Gynecology and  
obstetrics  
E L LILSON and DRURY HINTON—9 General surgery  
A BRUCE GILL—9 Orthopedics

## JEWISH HOSPITAL

Tuesday

M B BREND—9 General surgery  
W H TELLER—2 General surgery

Wednesday

F B BLOCK—9 General surgery  
L BRINKMAN—2 General surgery

Thursday

M BEHRE—9 General surgery  
F B BLOCK—9 General surgery

Friday

L BRINKMAN—9 General surgery  
W H TELLER—2 General surgery

## WOMEN'S HOMEOPATHIC HOSPITAL

Tuesday

JOHN A BROOKE—Orthopedics  
Wednesday

ARTHUR HARTLEY—General surgery  
Friday

FRANCIS L HUGHES—9 Gynecology

## PHILADELPHIA GENERAL HOSPITAL

Tuesday

FRANK C HAMMOND—1 Gynecological operation  
WILLIAM H MACKINNEY—Genito-urinary operation

Wednesday

ALFRED C WOOD—9 General surgery  
J T RUGH—11 Orthopedics  
STAFF—2 Symposium Cancer J B CARVETT general  
surgery HENRY K PANCOSK Rad of gy C C  
NORRIS gynecology J F SCHAMB and drist logy  
ROBERT C TORREY medical GEORGE M DORRANCE  
coma H ry F O LEWIS laryngology list to  
rad emanation pl t d d ep th rapy l hora  
t ries

Thursday

J B CARVETT J RALSTON WELLS ROBERT BRADLEY and  
JAMES P WEATHERWAY—9 Non-operative cancer  
clinical

FRANK A SCHUMANN—2 Gynecological operations.

Friday

T T THOMAS—9 General surgery  
C C NORRIS—11 Gynecological cancer operation  
EDWARD B KRAMER and staff of pathologists—4  
Clinical pathological conference demonstrating  
rental testing pathological and specimens.  
Open discussion in this conference

## ST. JOSEPH'S HOSPITAL

Tuesday

JOSEPH M SPELLISSY—9 Dry clinic Operative mechan-  
ical treatment of some of the effects of indigestion  
and  
JOHN F JONES—General surgery propelectomy

JOHN F JONES—General surgery propelectomy

Wednesday

MELVIN M FRANKLIN—9 General surgery influence of  
prosthetics upon amputation chondro tubercu-  
losis prostatic bone

F HURST MAIER—11 Gynecology hysterectomy of  
myofibromatous placenta retroflex

Thursday

JAMES A KELLY—9 General surgery fracture of the elbow

Friday

CHARLES F VASSAU—9 General surgery subtotal thy-  
roidectomy dermal cyst hernia operation of der-  
mal and anastomosis

P BROOKE BLAND—11 Gynecology application of rad-  
ium to uterine myofibromata tracheal larynx  
perineorrhaphy bladder hernia

## NORTHWESTERN GENERAL HOSPITAL

Tuesday

J O ARNOLD—2 Obstetrics clinical Penneotomy  
improved technique.

Wednesday

J T SCHILL—9 General surgery

Thursday

ARTHUR D KURTZ—33 Orthopedics dry clinic

Friday

ROBERT BOYER—1 Gynecology hysterectomy  
prostatectomy

## LANKENAU HOSPITAL

## Tuesday

STANLEY P. REIMAN—9 Demonstration in new laboratory

A. G. MILLER and ROBERT SHOEMAKER—11 Demonstration in roentgenology

F. L. HARTMAN—11 Demonstration of follow up system

## Wednesday

STANLEY P. REIMAN—9 Demonstration in new laboratory

F. L. HARTMAN—11 Demonstration of follow up system

A. G. MILLER and ROBERT SHOEMAKER—11 Demonstration in roentgenology

JOHN B. DEEVER—12 General surgery

## Thursday

F. L. HARTMAN—11 Demonstration of follow up system

A. G. MILLER and ROBERT SHOEMAKER—11 Demonstration in roentgenology

JOHN B. DEEVER—12 General surgery

WILLIAM H. MACKINNEY—530 Cytology

## Friday

STANLEY P. REIMAN—9 Demonstration in new laboratory

A. G. MILLER and ROBERT SHOEMAKER—11 Demonstration in roentgenology

F. L. HARTMAN—11 Demonstration of follow up system

## METHODIST EPISCOPAL HOSPITAL

## Tuesday

JAMES H. BALDWIN—9 Gas gangrene fore body in bladder fracture of patella fore body in brain

MILTON T. FENCIVAL—9 Daily demonstrations of X-ray technic of roentgenology pyelograms lithotripsy

## Wednesday

WILLIAM R. NICHOLSON—9 Vesicogastrocervical cystocele prolapse of uterus cervical repairs and repairs of perineum

LEVI JAY HAMMOND—9 Surgery of gastrointestinal stomach pleura and pericardium

## Thursday

DAMON B. PFEIFFER—9 Carcinoma of the recto sigmoid blood transfusions surgery of the gastrointestinal system and intestines

RICHARD C. NORRIS—9 Abdominal gynecology retroperitoneal uterus and ovaries tumors and neoplasms

## Friday

J. T. REAGAN—9 Arthrodesis of the cervical spine of paralytic deformities stabilization of the hip joint and pin and bone grafts

LEON HERMAN—11 Prostatectomy enucleation hypernephroma ligament tumors of the bladder cystoscopy and pyelography

## KENTINGTON HOSPITAL FOR WOMEN

## Tuesday

WILLIAM E. PARKER—9 Prenatal clinical history taking pelvic try blood pressure record obstetric laboratory

H. C. DEEVER—230 General surgical clinic

## Wednesday

DANIEL LONGAKER—11 Pathology of the testes and demonstration of abdominal malformations

## CHILDREN'S HOSPITAL

## Tuesday

J. H. JORSON—9 Diagnosis in surgical diseases of the abdomen

J. C. GITTINGS—9 Some medical aspects of surgical cases

C. W. BLAIR and F. E. LEAVITT—9 New surgical problems in children

C. C. NORRIS—2 Vaginitis in infants and young children methods of treatment

## Wednesday

W. F. STELLER and J. R. WELLS—9 Problems in thoracic surgery Treatment of bronchitis

R. S. BROMER—9 X-ray in thoracic and gastro-intestinal lesions

## Thursday

HOWARD C. CARPENTER—9 Health examination in children

EMILY P. BACON—9 Demonstration of nutritional problems in children

SUSAN C. FRANCHI—9 Problems in management of surgical disorders

## Friday

JOHN SPEESE and W. EDGAR CHRISTIE—9 Postoperative management of surgical cases

HENRY P. BROWN and LEONARD G. WILLIAMSON—9 Management of the surgical outpatient department

## MT. SINAI HOSPITAL

## Tuesday

CHARLES F. NASSAU—9 Radical cure of hernia local anesthesia

G. ROSEBAUM—12 X-rays of gastrointestinal tract

## Wednesday

M. BEHREND—9 Surgery of bile passages and gastrointestinal tract presentation of cases

M. COOPERMAN—9 Cerebral rithmus d'elocution of the brain a traumatic myelitis and reconstruction of the brain

G. T. CHER—4 Bronchopneumonia and esophagitis

## Thursday

J. C. HIRST—9 Prolapse of uterus cystoscopy vaginoplasty

G. ROSEBAUM—2 X-rays of gastrointestinal tract

G. TUCKER—4 Bronchoscopy and esophagoscopy

## Friday

C. MAZER—9 Plaster cast test and pyelography

C. HIRSH—30 Demonstration of cases

## AMERICAN ONCOLOGIC HOSPITAL

## Tuesday

W. S. NEWCOMET—9 Cases of a goma treated and dermal tumor selected from a group of 300

SAMUEL McCLEARY—3rd—9 Cases of cancer of the lip and mouth

## Wednesday

W. S. NEWCOMET and SAMUEL McCLEARY—3d—30 Cases of malignant diseases being treated with radium case of cancer of the lip birth mark

## Friday

W. S. NEWCOMET and SAMUEL McCLEARY—3d—3 Cases of malignant diseases being treated with radium review of the cases treated with radium

## HUNEMANN HOSPITAL

Tuesday

- L T ASHCRAFT WILLIAM C HUNICKER FRANK C BENSON JR—9 Urologic clinic Symposium on tumors of the urinary bladder and on carcinoma of the prostate Demonstration of local anesthetics
- J E JAMES JR and LEON CLEMMER—10 Obstetric clinic Salt points in pelvic surgery The rôle of version in obstetrical surgery Cervico-abdominal hysterectomy
- F W SMITH—2 Bronchoscopy work in the cadaver
- F C BENSON JR—3 Radiological clinic Technique of application and results in superficial malignant tumors Limitations of contraindications and dangers in radium therapy

Wednesday

- H L NORTHROP—9 Thoracic surgery
- D B JAMES and E B CRAIG—9 Gynecological clinic Malignancy of the uterus
- W C MURPHY and J B BERT—10 Obstetric clinic Forceps application with special reference to the cephalic application in posterior oblique positions The mechanism of labor
- S W SAPPIN—10—3 Demonstration of anastomosis of blood transfusion

Thursday

- J D ELLIOTT and WILLIAM F SYLVIS—9 Operative clinic Tumors of the breast Discussion of the pathology and end results of treatment by X-ray radiation and operation
- D B JAMES—9 Gynecological clinic
- O B WAITE and N F LAYSON—9 Obstetric clinic Prenatal case Practical results of routine Wassermann tests in eclampsia and eclampsia in Tetanus

- J A BROOKE—2 Orthopedic clinic Shortening of bones of the leg to correct inequality in length Demonstration of new bone shield Results of astraglectomy in paralytic foot

- J W FRANK—3 Roentgenological clinic Comparison of new form of roentgen treatment for malignancy with former methods Results in patients

Friday

- G A VAN LENNEP and H P LEOPOLD—9 Surgery of the stomach and duodenum
- N F LAZAR and W CULLEN—9 Uterine bleedings and gynecosis and treatment

## ORTHOPEDIC HOSPITAL

Tuesday

- ASTLEY F C ASHURST FOTHERFORD L JOHN EDWARD T CROSSAN and B I BLIZBY—Orthopedic demonstration

Wednesday

- ASTLEY F C ASHURST FOTHERFORD L JOHN EDWARD T CROSSAN and B I BLIZBY—9 Orthopedic operation

Friday

- A BRUCE GILL C R BOWEN and JAMES E WYATT—Orthopedic clinic

## ST CHRISTOPHER'S HOSPITAL

- E G ALEXANDER—1 Surgical clinic Hernia appendix pyloric stenosis, undescended testicle, harelip, emphysema and bone cancer Surgery of the larynx

## WOMAN'S HOSPITAL

Tuesday

- SARAH H LOCKREY and EMILY WHITTE ALGER—9 Gynecological clinic
- LIDA STEWART COCILL and ELIZABETH HUGHES—2 Obstetrical clinic
- JULIA HARDIN—2 Demonstration of gas-oxygen and ethyl anesthesia

Wednesday

- MARIE K. FORMAN and ALBERTA PELTZ—9 Gynecological clinic
- ELLA WILLIAMS CRIMA and ALBERTA PELTZ—3 Obstetrical clinic
- JULIA HARDIN—2 Demonstration of gas-oxygen and ethyl anesthesia

Thursday

- CATHARINE M CEARLANE and FAITH S FETTERMAN—9 Gynecological clinic
- KATE W BAILLY—1 General surgery
- MARY LEWIS and DELLA MILDENHALL—3 Obstetrical clinic
- JULIA HARDIN—2 Demonstration of gas-oxygen and ethyl anesthesia

Friday

- ELIZABETH F C CLARK—9 Gynecological clinic
- ANN TOMKINS GIBSON and JESSIE W PRYOR—2 Obstetrical clinic
- EMILY WHITTE ALGER—3 General surgery
- JULIA HARDIN—2 Demonstration of gas-oxygen and ethyl anesthesia

## ST LUKE'S HOSPITAL

Tuesday

- DESIDERIO ROMAN—9 General surgery
- O F BARTHMEIER—1 Demonstration of blood transfusion

Wednesday

- A B WEBSTER—9 General surgery
- J WALTER POST—1 Demonstration of roentgenology
- WILLIAM C HUNICKER and J MILLER KENWORTHY—2 Genito-urinary surgery and cystoscopy

Thursday

- DESIDERIO ROMAN—9 Operation upon thyroid and demonstration of gross study of thyroid disease

Friday

- A B WEBSTER—9 General surgery
- J WALTER POST—2 Demonstration in roentgenology
- WILLIAM C HUNICKER and J MILLER KENWORTHY—2 Genito-urinary surgery and cystoscopy

## CHILDREN'S HOMOEPATHIC HOSPITAL

Tuesday

- H P LEOPOLD—General surgery

Wednesday

- JOHN BROOKER—2 Orthopedic clinic After results in physical culture club hand syphilis, joints, intussusceptions, doctored turbances

Thursday

- A HORWOOD JR—2 Obstetrical clinic

## STETSON HOSPITAL

*Tuesday*

JOHN A. BOGER and WILLIAM T. ELLIS—1 General surgery herniotomy appendectomy cholecystotomy reduction of fractures

*Wednesday*

E. TRACY and Associates—9 Gynecological clinic  
Plastic operations trachelorrhaphy trachelectomy anterior colporrhaphy perineorrhaphy myometomy and hysterectomy for fibroids shortening of the round ligaments conservative operations for pelvic inflammatory conditions

*Thursday*

BROOKS M. ANSPACH and Associates—9 Gynecological clinic

*Friday*

E. TRACY and Associate—9 Gynecological clinic  
CARL F. KOENIG—1 Rectology Digestive deep therapy clinic

## WOMAN'S COLLEGE HOSPITAL

*Tuesday*

LIDA STEWART COGILL—9 Perinatal clinic

*Wednesday*

J. S. RODMAN and staff—9 General surgery

*Thursday*

CATHARINE MACFARLANE—2 Gynecology

*Friday*

J. S. RODMAN and staff—9 General surgery

## COOPER HOSPITAL (Camden)

*Tuesday*

THOMAS B. LEE ALBERT B. DAVIS and GORDON WEST—9 Gynecology

*Wednesday*

PAUL M. MCCRAY and Associates—0 General surgery  
A. H. INES LIPPINCOTT and DAVID BENTLEY JR—2 3  
Genito-urinary and rectal clinic  
B. F. BLIZBY—2 30 Orthopedic clinic

*Thursday*

THOMAS B. LEE ALBERT B. DAVIS and GORDON WEST—9 Gynecology

*Friday*

PAUL M. MCCRAY and Associates—10 General surgery  
B. F. BLIZBY—30 Orthopedics

## CHESTNUT HILL HOSPITAL

*Tuesday*

ANDREW GODFREY and WILLIAM SHEEHAN—0 General surgery

ALEX. R. DALL—2 Urologic clinic

*Wednesday*

J. MURRAY ELLZEY—10 Fracture clinic

*Thursday*

J. F. MCCLOSKEY—10 General surgery

## EVANS INSTITUTE

R. H. IVY and LAWRENCE CURTIS—Wednesday 10 Oral surgery

## SURGERY OF THE EYE EAR NOSE AND THROAT

## CLINICAL DEMONSTRATIONS AND PAPERS

Ballroom Bellevue Stratford

Tuesday—9 a m

Group conference on problems related to the Hospital  
Standardization Program as applied to ophthalmological and otolaryngological services J A BABBITT  
Chairman

Wednesday—9 a m

PHILIP FRANKLIN London England The Clinical Aspects  
of Tonsillitis

Discussions on GEORGE B WOOD, Philadelphia C W  
RICHARDSON Washington C G COAKLEY New  
York

CHEVALIER JACKSON Philadelphia Laryngofissure for  
Cancer of the Larynx

Discussions on HARMON SMITH New York H W LOES  
St Louis LOUIS H CLERY Philadelphia

HARRY S GRADLE Chicago The Practical Use of the Slit  
Lamp in Daily Routine

Discussions on HUNTER H MCQUIRE Winchester Va  
ALFRED COWAN Philadelphia LUTHER C PETER  
Philadelphia

DOUGLAS QUICK New York Use of Radium and X-ray in  
the Treatment of Malignant Disease of the Paranasal  
Sinuses

Discussions on D CROSBY CREENE Boston CHARLES  
E PAULSON Philadelphia G E PFISTER  
Philadelphia

JOHN E MACKENTY New York Laryngotomy in One  
Stage Comments on Oehlert's Operations  
Discussions on FIELDING O LEWIS Philadelphia

Thursday—9 a m

F EARNEST WHITVALL Montreal Canada Tonsil  
Capsul

J C BECK Chicago Some of the Important Complications  
from Ear Nose and Throat Disease and Operations  
and Their Management

Discussions on GEORGE M COATES Philadelphia  
RALPH BUTLER Philadelphia

E C ELLETT Memphis Tenn The Use of the Suture in  
Cleft Lip and Palate

Discussions on LEWIS ZIEGLER Philadelphia WILLIAM  
ZENTMAYER Philadelphia

WELLS P EAGLETON Newark N J Meningitis of Aural  
Origin

Discussions on S MACCUEEN SMITH Philadelphia  
JAMES A BABBITT Philadelphia H I LILLIE  
Rochester Minn

T E CARMODY D C Observations on Children's  
Sinuses in Health and Disease

Discussions on ROSS H SKILLERN Philadelphia LEON  
E WHITE Boston

Friday—9 a m

MAJOR EDMUND B SPAETH Takoma Park Md Ophthalmic  
Plastic Surgery Lantern slides demonstration

GEORGE M DORRANCE Philadelphia Rhinoplasty presentation  
of cases and lantern slides demonstration

WARREN B DAVIS Philadelphia Some Types of Harelip  
and Cleft Palate Deformities and Their Operative  
Results Presentation of patients and lantern slides  
demonstration

CHARLES F NASSAU Philadelphia Cure of Laryngostomic  
Fistulae Lantern slides and demonstrating pictures  
demonstration

## EPISCOPAL HOSPITAL

Tuesday

W R WATSON E W COLLINS O C HIRST and J H  
SCHAEFFER—Otolaryngology

HAROLD G GOLDBERG D J BOONE and WILLIAM H  
CHANDLER—Ophthalmology

Wednesday

A G FEWELL W S REESE J B RUDOLPH and F  
HERBERT JR—Ophthalmology

W R WATSON E W COLLINS O C HIRST and J H  
SCHAEFFER—Otolaryngology

Thursday

FREDERICK KRAUSS and J B FELDMAN—Ophthalmology

CHARLES C BIEDERT T R CURRIE and WILLIAM  
MATTHEWS—Otolaryngology

A G FEWELL W S REESE J B RUDOLPH and F  
HERBERT JR—Ophthalmology

Friday

C C BIEDERT T R CURRIE and WILLIAM MATTHEWS—  
Otolaryngology

HAROLD G GOLDBERG D J BOONE and W H CHANDLER—  
Ophthalmology

## POLYCLINIC HOSPITAL

Tuesday

T B HOLLOWAY—Ophthalmology

Wednesday

WALTER ROBERTS—Otolaryngology

E B GLEASON—Otolaryngology

L C PETER—Ophthalmology

Thursday

GEORGE B WOOD—Laryngology

Friday

RALPH BUTLER—Laryngology

## HOWARD HOSPITAL

Tuesday

G B WOOD—Laryngology

Wednesday

W C POSEY—Operations on the

Thursday

G B WOOD—Laryngology

Friday

W C POSEY—Ophthalmology

## ST AGNES HOSPITAL

Tuesday

BENJAMIN D PARISH—Otolaryngology

Wednesday

WARREN B DAVIS—Otolaryngology

GEORGE F J KELLY—Ophthalmology

## ST JOSEPH'S HOSPITAL

## Tuesday

GEORGE M. MARSHALL—2 Otolaryngology otoplasty correction of the nasal bones radical maxillary sinus operation

PAUL J. PONTILS—2 Ophthalmology enucleation with gold ball insert in iridectomy

## Wednesday

CHARLES J. JONES—2 Ophthalmology prophylactic iridectomy for cataract complete traction

WILLIAM E. QUICKSALL—2 Otolaryngology tonsillectomy by Fetterolf's method submucous resection

## Thursday

THOMAS A. O'BRIEN—2 Ophthalmology combined extraction Elliott traphan for glaucoma

ARTHUR WRIGLEY—2 Otolaryngology replacement of larynx by latissimus dorsi flap of quadrangular resection of larynx with submucous resection tonsillectomy by decapitation with dissection and snare

CORNELIUS T. MCCARTHY—2 Otolaryngology radical mastoidectomy ethmoidectomy

## JEFFERSON HOSPITAL

## Thursday

FIELDING O. LEWIS—2 Otolaryngology

## Friday

HOWARD F. HASELL and WILLIAM M. SWEET—2 Ophthalmology

S. MACCUEEN SMITH and J. CLARENCE KEELER—2 Otolaryngology

## MISERICORDIA HOSPITAL

## Saturday

JOHN E. LOFTUS—2 Otolaryngology

## Sunday

C. T. MCCARTHY—2 Otolaryngology

HAROLD GOLDBERG—3 Ophthalmology

## Monday

JOHN E. LOFTUS—2 Otolaryngology

JOHN A. COLGAN—3 Ophthalmology

## Tuesday

C. T. MCCARTHY—2 Otolaryngology

## WOMAN'S COLLEGE HOSPITAL

## Wednesday

MARGARET F. BUTLER—2 Otolaryngology

## Thursday

MARY BUCHANAN—3 Ophthalmology

## JEWISH HOSPITAL

## Sunday

J. KNIFE—3 Eye clinic

## Monday

S. MCC. SMITH and A. S. KAUFMAN—3 Otolaryngology

H. M. GODDARD—4 Laryngeal and throat clinic

## WILLS EYE HOSPITAL

## Tuesday

BURTON CHANCE FRANK C. PARKER LEIGHTON F. APPELMAN and BENJAMIN F. BAER JR.—2 Ophthalmic operations

## Wednesday

WILLIAM ZENTMAYER PAUL J. PONTILS J. MILTON GRISCOM and THOMAS A. O'BRIEN—2 Ophthalmic operations

## Thursday

BURTON CHANCE FRANK C. PARKER LEIGHTON F. APPELMAN and BENJAMIN F. BAER JR.—2 Ophthalmic operations

## Friday

WILLIAM ZENTMAYER PAUL J. PONTILS J. MILTON GRISCOM and THOMAS A. O'BRIEN—2 Ophthalmic operations

## UNIVERSITY HOSPITAL

## Saturday

THOMAS B. HOLLOWAY—2 Ophthalmology  
G. FETTEROLF J. A. BABBITT D. HUSIK and LEWIS FISHER—3 Otolaryngology

## Sunday

G. FETTEROLF J. A. BABBITT D. HUSIK and L. FISHER—3 Otolaryngology

## Monday

THOMAS B. HOLLOWAY—2 Ophthalmology

## Tuesday

THOMAS B. HOLLOWAY—2 Ophthalmology  
GEORGE FETTEROLF J. A. BABBITT DAVID HUSIK and LEWIS FISHER—2 Otolaryngology

## MIT SINAI HOSPITAL

## Wednesday

L. FISHER—2 Tonsillectomy and sinus surgery BARD test  
C. W. LEFEVER—4 Cerebral glaucoma muscle work

## Thursday

S. J. GITTLESO—2 Demonstration of cases

## Friday

A. W. WATSON—2 Mastoid and tonsil surgery

## METHODIST EPISCOPAL HOSPITAL

## Saturday

WALTER ROBERTS—2 Radical septum tonsillectomies and tonsillectomies mastoid disease and malignant disease of the larynx bronchoscopy  
PHILIP H. MOORE—4 Euclyptus tree body in the strabismus glaucoma

## CHILDREN'S HOSPITAL

## Wednesday

H. MAXWELL LONDON and A. R. RENTNAGER—2 Ophthalmology

## Thursday

JAMES A. BABBITT and Staff—2 Otolaryngology



## MEDICO CHIRURGICAL HOSPITAL

*Tuesday*

GEORGE M COATES—2 Otolaryngology

*Wednesday*

ROSS H SKILLERN—2 Laryngology

*Thursday*

GEORGE M COATES—2 Otolaryngology

*Friday*

POSS H SAILLERN—2 Laryngology

## ST MARY'S HOSPITAL

*Tuesday*

FRANK MURPHY—2 Eye clinic

*Wednesday*

EDWARD MURPHY, WILLIAM P GRADY and ALBERT J DEVLIN—3 Otolaryngology

## HAHNEMANN HOSPITAL

*Tuesday*

G J PLEN—2 Removal of mastoid operation by otologist department.

*Thursday*

H S WEAVER and C B HOLLIS—2 Nose and throat clinic

*Friday*

F O NAGLE—2 Eye clinic Pathology of the eye

## STETSON HOSPITAL

CARLE L FELT and Associates—Otolaryngological clinic Tonsillectomy and adenoidectomy mastoidectomy resection of ptosis

## NORTHEASTERN HOSPITAL

*Wednesday*

GEORGE E SHAFFER—2 Caldwell-Lyc operation

GRNVILLE A LAWRENCE—4 Ophthalmology

## UNIVERSITY OF PENNSYLVANIA MEDICAL SCHOOL

E B GLEASON and PHILIP S STOUT Operate on the mastoid and labyrinth. Demonstration on the cadaver

## SAMARITAN HOSPITAL

LUTHER C PETER—Tuesday 4 Ophthalmology

## PRESBYTERIAN HOSPITAL

*Friday*NATHAN P STAUFFER, W L CARISS and O R KLINE—2 Otolaryngology  
H MAXWELL LANGDON and J MONROE THORINGTON—2 Ophthalmology

## WOMAN'S HOSPITAL

*Tuesday*

LAURA E HUNT and MARY HIPPLE—2 Otolaryngology

*Wednesday*MARGARET A WARLOW—1 3 Otolaryngology  
MARY BUCHANAN—2 Ophthalmology*Thursday*

MARGARET F BUTLER and LOIS VAN LOON—Otolaryngology

## CHESTNUT HILL HOSPITAL

*Wednesday*

BENJAMIN PARISH and JOHN DAVIES—2 Otolaryngology

*Thursday*

CARL WILLIAMS—2 Ophthalmology

## COOPER HOSPITAL (Central)

*Tuesday*

L B HIRST, E R HIRST and ALFRED ELWELL—2 30 Otolaryngology

*Thursday*

L B HIRST, E R HIRST and ALFRED ELWELL—2 3 Otolaryngology

## FRANKFORD HOSPITAL

*Tuesday*FRANK EMBERY—9 30 Tonsillectomy clinic  
W J WATSON—9 30 Tonsillectomy clinic

## CHILDREN'S HOMEOPATHIC HOSPITAL

FRED W SMITH—Tuesday Laryngological clinic by peritonsillar abscess and denoids

## WOMEN'S HOMEOPATHIC HOSPITAL

JOSEPH F V CLAY—Thursday Otolaryngology

## PHILADELPHIA GENERAL HOSPITAL

DAVID N HUSIK—Friday 2 Otolaryngological operations

# SURGERY, GYNECOLOGY AND OBSTETRICS

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URETERAL STRICTURES, KINKS AND ABNORMAL INSERTS<sup>1</sup>

DANIEL N. FISCENDRATH, AB, MD, FACS, CHICAGO

ALTHOUGH there is much difference of opinion in regard to the frequency and clinical importance of ureteral strictures we are indebted to Hunner for directing our attention to the necessity of using special bougies supplemented by ureteropyelography in searching for these conditions. The latter method has revealed that two other ureteral conditions viz kinks and abnormal insertions into the renal pelvis can be more easily demonstrated than has ever before been possible and hence must also be taken into consideration when an attempt is made to interpret the source of symptoms such as abdominal pain or those more strictly referable to the urinary tract. For this reason it has been deemed advisable to consider strictures kinks and abnormal inserts together.

Here as elsewhere a knowledge of what is normal is essential hence let us first take up this portion of the subject.

## ANATOMY OF THE URETER

*Length* According to Schwilbe Zondek and Waldeyer the ureter varies in length in men from 28 to 34 centimeters the right being 1 centimeter shorter than the left In women the average length of the left ureter is 29 centimeters and of the right 27.5

**Variations in caliber** Studies at all periods of prenatal and postnatal life have revealed

four levels at which the lumen is narrow and three where it is wider. They are easily seen in fetal specimens (Fig. 1) in casts<sup>2</sup> of adult ureters (Figs. 2 and 3) as well as in ureteropyelograms of apparently normal individuals (Fig. 4). These anatomical and clinical observations reveal much variation in the caliber of the ureter at different levels. The following table will give the diameter and the size of a ureteral catheter or bougie which can be introduced under normal conditions.

Ur t	L t	D m t	th
I um f a	p l j u n c t n	m m	6 F e n c h
A t t	s p i l l	1 m m	3 F e n c h
I l	p i d l g	4 m m	12 F r e n c h
J t	a l	4-6 m m	1 t 8 F r n c h
I t m l		5 m m	3 t 5 F r n c h
		5 4 m m	9 t o 3 F e n c h

An occasional glance at such figures is of the utmost importance in our examination of cases for suspected strictures.

### VALUE OF URETEROCELEOGRAPHY

As will be mentioned later ureteropyelography in my opinion is an indispensable part of our clinical examination but we must learn to interpret the films after consideration of the following

There may be considerable deviation from the classical type of ureter shown in Figures 2 and 3. The levels at which the narrowings occur may be higher or lower and

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 sc l h m ph sc nd rs pply f bee m d h m en l lic l by h l D By R b so se som f  
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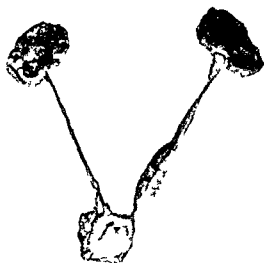


Fig 1 A t p s y s p e c i m e n f r o m t h e d a y o l d i n f a n t N o t f o m a b o d n w r d o n l e f t s i d e t h e r r i n g t j u t o f a p l i s w i t h e t e t h l a t l y m a l l l u m b a r p a d l e n a r r o w g a t c o g o f l c e l t h l g p a d l e l i k e d i l t a t o n f e l p o t o n f e t a n d f i n a l l y t h e n r r o n g ( j u t a e s c a l ) e a r t h t r a c e t t h e b l d d e r w a l l

the narrowing (Fig 5) may extend over an unusually large section of the ureter

2 In certain normal individuals who present no clinical symptoms on the side on which a ureteropyelogram has been made for purposes of comparison a kink may be found (Fig 6) as a result of a redundancy or folding up of the normal ureter

3 A kink may be artificially produced if only one picture is taken i e without with drawing the opaque catheter and making a second exposure (Fig 7)

Dr R A Arens<sup>1</sup> and myself have been greatly interested in a study of whether or not the ureter of an apparently normal individual will show a wider shadow when a large quantity of the opaque medium is injected under considerable pressure. This is of the utmost importance in the interpretation of films made in cases in which stricture is suspected. We obtained the urinary organs intact at the autopsy of a man who died following a stab wound of the neck. Ureteral catheters were inserted transversally and tied in place so as to prevent back

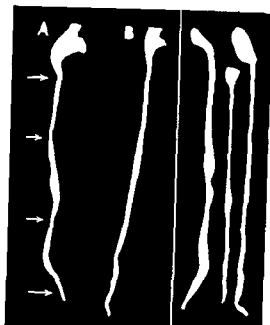


Fig 2 (1 ft) C t o f n o r m a l a d u l t u t e r s m a d e b y D r s B y R b s o n d W i l l m E H l l d A A r r o p i t t o t h f r n r r w g v f m a b o e d w n r d u t p l j i u p p o r t n f l u m b a u t e c r o g f i l a c e l a n d j t a e s c a l l y C o m p e t h F g u r w h e u p p l m b a n r r w g i s a b s n t B C t h n g l y a m d f f u s e a r r i g l m b a u t t h t c r o n g f i l c e s s l a n d a t h i r d j t a l

Fig 3 Three t (R o b s o n d H o l l d) s h i g m k d d t i f m t h e n o r m a l l e l s f n r r g S h a r t m t b t a k e n t c o n i t i n i t e r p r t i g p y l o g m s

flow into the bladder. When 10 cubic centimeters of opaque medium was injected on each side with as much pressure as is ordinarily employed in making a ureteropyelogram the film revealed a shadow with all of the normal level of narrowing and widening (A of Fig 8). When 20 cubic centimeters were injected under considerable pressure on both sides there was practically no change in the shadow (B of Fig 8) but as you will note the fluid was forced into the renal parenchyma as occurred in our collargol experiments. This observation would indicate that the amount of fluid and pressure play but little part in widening the shadow of the ureter. We must remember however that when inflammatory changes especially those of long standing are present in the



Fig 4

Fig 5 A

Fig 5 B

Fig 4 Normal ureter. Observe the wings between which the pindle are. The shadow of the lumbar vertebrae is seen. The shadow of the ureter is seen. The shadow of the catheter is seen.

Fig 5 Normal ureter. Observe the wings between which the pindle are. The shadow of the lumbar vertebrae is seen. The shadow of the ureter is seen. The shadow of the catheter is seen.

ureteral wall a wider shadow (Fig 9) is the rule

The possibility of the existence of such an inflammatory dilatation must be considered in the interpretation of a relatively wide shadow when stricture is suspected

#### STRICTURES OF THE URETER

I will limit myself to the discussion of the following questions concerning which there is still much difference of opinion

1 Are all strictures seen in children and adults to be regarded as of inflammatory origin?

2 Are strictures as frequent as Hunner and others would have us believe and are their methods of examination free from criticism?

Taking up the first question we agree that strictures of the ureter are to be found before birth and that they occur at the levels (Figs 1, 2 and 3) where the ureter is normally



Fig 6 Well made kink found by accident in which bilateral ureter pyelograms were made. There were no subjective symptoms and no urologic findings on the deformity which the well made

narrower. In a previous contribution<sup>1</sup> I reported 6 cases which could be most easily explained as being of congenital origin and a

S. G. C. L. N. H. Am. 4 635



Fig 7 How an artificial kink can be produced in the ureter. The kink is produced at the left side of the catheter while the catheter is being withdrawn. The kink is produced at the right side of the catheter while the catheter is being withdrawn.



Fig. 8 C 1 p m n t t l t m d l t b l y f a d l t h u m u t A (l t) N t e u p p e d l l m b  
a w i f l t u t O l y i t t m e t w i j t d b e f t h f l m w e x p o d B (n h t) N t h w  
l t l c h h t a k n p l c c t f t r s w h n c l b c t m t r s e r e j c t d T h j j m d m w  
f o r e l n t t h e l p n c h m

number of similar cases have been reported by others. I have recently had a seventh clinical case which I will cite briefly and then add a follow up report of the sixth case.

This latest case was a girl of 14 years suffering for a year from recurrent attacks of pain over the left kidney region radiating along the course of the ureter. The attacks had recurred more frequently and the severity of the pain had increased greatly before she was first seen with Dr. Carl Beck of this city. A distinct resistance to a No. 6 catheter was met in the upper third of the ureter at the first examination. The ureteropyelogram (Fig. 10) revealed a distinct narrowing at the point of obstruction. At subsequent sitting we were able to introduce a No. 7 bougie through the strictured area in the lumbar region and a little later a No. 8 F bougie but a No. 9 could never be passed.

She had a slight recurrence of pain about 4 weeks after a No. 8 had been introduced

but has been free from pain now for over 4 months.

In the case of the little girl of 6 previously reported we have been informed that with the exception of one light attack of pain in the summer of 1914 there has been no recurrence since the crisis of dilatation (given in December 1923) of the stricture at the vesical outlet of the ureter.

It is not my contention that every stricture encountered in adult life is of congenital origin but I believe that the number is far greater than Hunner, Caulk and others have been willing to grant.

Now in regard to the second question viz: Do we overlook stricture as often as Hunner claims or are his own method of examination open to criticism?

Before discussing the two aspects let me say that no one appreciates more highly than the writer that Hunner's work has been so valuable in directing our attention to a clinical



I At l ft te py l g m f m e s e f str c  
t fl mb p r t f r i g h t u r t f l l j g b l o  
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L p o m l h u a f t j t n f p q m d u m  
N t t t i m a l t t c t e d e a

F g o l l t t U t p y l g m f f f l m m t r v  
d l t t f t h t d l l l  
F g U t p y l g m m d f g l f 4 t h  
t n t f t h p p e p o t f t h l m l (l f t) t  
t h h p t t t t

entity of which many experienced urologists even today deny the existence. I also have the highest admiration for the integrity and perseverance of the chief protagonist of the frequency of ureteral strictures. It is necessary however for us to have an open mind to look at the question in a judicial manner and to ascertain whether the evidence justifies the verdict that ureteral strictures occur as frequently as is maintained. First of all we must be thoroughly familiar with the normal ureter as described at the beginning of this article and second our methods of examination must be above criticism.

I am of the opinion from personal observation of Dr Hunner's work and an unbiased study of a relatively large percentage of cases that the so called hang test is not above dispute. If one watches through an operating cystoscope the wax bulb during its withdrawal one will see that the hang is obtained at a point where the ureter is normally very narrow i.e. at the vesical outlet. Again the angle formed by the juxtavesical and intraparietal portions of the ureter will lead us astray unless we bear it in mind in withdrawing the bulb. The use of solid bougies of varying sizes in determining the caliber of the different levels of the ureter is more accurate than any other method. Because of the possibility of being deceived when the bulb bougies are employed it is open to question whether the examination for the presence of ureteral strictures should not be limited to the ureteral bougie plus ureteropyelography. As Iathbun has recently pointed out this latter method should be carried out by first filling the renal pelvis and then making one exposure. A little more



FIG. 8. (Left) percutaneous insertion of catheter into the ureter. (Right) catheter in the ureter. (Third) catheter in the ureter. (Fourth) catheter in the ureter. (Fifth) catheter in the ureter. (Sixth) catheter in the ureter. (Seventh) catheter in the ureter. (Eighth) catheter in the ureter. (Ninth) catheter in the ureter. (Tenth) catheter in the ureter. (Eleventh) catheter in the ureter. (Twelfth) catheter in the ureter. (Thirteenth) catheter in the ureter. (Fourteenth) catheter in the ureter. (Fifteenth) catheter in the ureter. (Sixteenth) catheter in the ureter. (Seventeenth) catheter in the ureter. (Eighteenth) catheter in the ureter. (Nineteenth) catheter in the ureter. (Twentieth) catheter in the ureter. (Twenty-first) catheter in the ureter. (Twenty-second) catheter in the ureter. (Twenty-third) catheter in the ureter. (Twenty-fourth) catheter in the ureter. (Twenty-fifth) catheter in the ureter. (Twenty-sixth) catheter in the ureter. (Twenty-seventh) catheter in the ureter. (Twenty-eighth) catheter in the ureter. (Twenty-ninth) catheter in the ureter. (Thirtieth) catheter in the ureter. (Thirty-first) catheter in the ureter. (Thirty-second) catheter in the ureter. (Thirty-third) catheter in the ureter. (Thirty-fourth) catheter in the ureter. (Thirty-fifth) catheter in the ureter. (Thirty-sixth) catheter in the ureter. (Thirty-seventh) catheter in the ureter. (Thirty-eighth) catheter in the ureter. (Thirty-ninth) catheter in the ureter. (Fortieth) catheter in the ureter. (Forty-first) catheter in the ureter. (Forty-second) catheter in the ureter. (Forty-third) catheter in the ureter. (Forty-fourth) catheter in the ureter. (Forty-fifth) catheter in the ureter. (Forty-sixth) catheter in the ureter. (Forty-seventh) catheter in the ureter. (Forty-eighth) catheter in the ureter. (Forty-ninth) catheter in the ureter. (Fiftieth) catheter in the ureter. (Fifty-first) catheter in the ureter. (Fifty-second) catheter in the ureter. (Fifty-third) catheter in the ureter. (Fifty-fourth) catheter in the ureter. (Fifty-fifth) catheter in the ureter. (Fifty-sixth) catheter in the ureter. (Fifty-seventh) catheter in the ureter. (Fifty-eighth) catheter in the ureter. (Fifty-ninth) catheter in the ureter. (Sixtieth) catheter in the ureter. (Sixty-first) catheter in the ureter. (Sixty-second) catheter in the ureter. (Sixty-third) catheter in the ureter. (Sixty-fourth) catheter in the ureter. (Sixty-fifth) catheter in the ureter. (Sixty-sixth) catheter in the ureter. (Sixty-seventh) catheter in the ureter. (Sixty-eighth) catheter in the ureter. (Sixty-ninth) catheter in the ureter. (Seventieth) catheter in the ureter. (Seventy-first) catheter in the ureter. (Seventy-second) catheter in the ureter. (Seventy-third) catheter in the ureter. (Seventy-fourth) catheter in the ureter. (Seventy-fifth) catheter in the ureter. (Seventy-sixth) catheter in the ureter. (Seventy-seventh) catheter in the ureter. (Seventy-eighth) catheter in the ureter. (Seventy-ninth) catheter in the ureter. (Eightieth) catheter in the ureter. (Eighty-first) catheter in the ureter. (Eighty-second) catheter in the ureter. (Eighty-third) catheter in the ureter. (Eighty-fourth) catheter in the ureter. (Eighty-fifth) catheter in the ureter. (Eighty-sixth) catheter in the ureter. (Eighty-seventh) catheter in the ureter. (Eighty-eighth) catheter in the ureter. (Eighty-ninth) catheter in the ureter. (Ninetieth) catheter in the ureter. (Ninety-first) catheter in the ureter. (Ninety-second) catheter in the ureter. (Ninety-third) catheter in the ureter. (Ninety-fourth) catheter in the ureter. (Ninety-fifth) catheter in the ureter. (Ninety-sixth) catheter in the ureter. (Ninety-seventh) catheter in the ureter. (Ninety-eighth) catheter in the ureter. (Ninety-ninth) catheter in the ureter. (One hundred) catheter in the ureter.

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Fig 15

Fig 16 A

Fig 16 B

Fig 15 Typical kink in the ureter of a normally functioning kidney. Not dilated calyx.

Fig 16 A (left) Uret. opy. m. show g both k k in the upper third of the ureter and strict t th ureteropel c j tion with re lta t re al nf ctuo B (ght) Uret opy logram made of a c se f tri tur at ureteropel c juncti n with marked dil t n f re l pel i a d calyces



Fig 7 A (left) From woman of 30 years history of recurrent pain in the right kidney. Not operated upon. B From man of 45 years history and findings as in A. Not operated on. C From woman of 30 years history of recurrent pain in the right kidney. No relief from appendectomy some years before. Pelvic dilatation but little change in calyces. Not operated upon.

of the early history of duodenal ulcer when those who opposed the idea that it was a frequent clinical finding based their argument upon the rarity of its occurrence at autopsy as pointed out by Rokitsky.

Improved diagnostic technique and study of the living tissue (at the operating table) has convinced everyone however that duodenal ulcer is far more common than was formerly thought and it must be excluded in every case with upper abdominal symptoms.

Hunner Rathbun and others have rendered an invaluable service in their pioneer work. Those who like myself have maintained a spirit of impartiality toward the question are convinced of the far more frequent occurrence of ureteral stricture than was formerly thought to be the case.

The search for the cause of abdominal pain must therefore at the present time include an examination of the ureter for stric-

ture preferably at a second sitting after all of the data except this has been obtained. It is not always an easy task to secure all of the desired information at the first sitting in our experience because so much time is consumed in collecting urine at each examination making functional tests etc. that it is often advisable either to look for stricture alone at the first sitting and to complete the urological study at a second or to reverse the order.

During the past 3 years I have found in patients of all ages strictures when least suspected by keeping their possible presence in mind in cases of abdominal pain of obscure origin in recurrent ureteral colics or calculus formation in hæmaturia and in persistent pyelitis. In these cases the improvement obtained after dilatation combined with pelvic lavage ought to convince anyone with an open mind that he who overlooks the occurrence of ureteral stricture is neglectful of his duty toward the patient.



## URETERAL KINKS

The same position which we have urged taking toward stricture must be our guide in this comparatively new clinical entity. That kinks are often found upon inspection of a normal ureteropyelogram (Fig. 6) can no longer be denied by those who claim that every kink must be followed by symptoms due to its presence.

Our ability to demonstrate the kink as the first step in the production of Duttl's crises in abnormally movable kidney (Fig. 15) and also a development of the subject of kinks. Redundancy of the ureter (Fig. 6) will account for many of the reduplication seen in patient without symptom or other findings than the ureteropyelogram. As in ureteral stricture there are no doubt cases in which the kink plays an important part in the production of abdominal pain, recurrent colic, persistent pyelitis, etc. Hence it should not always be regarded as an accidental finding. Its presence in the ureteropyelogram should be carefully considered in conjunction with the other urological findings, as well as the clinical history. It can be artificially produced by making only one exposure (Fig. 7) while the tip of the opaque catheter is still at a relatively high level in the ureter. It is advisable also in the case of ureteral strictures to withdraw the catheter completely before a second exposure is made. In order to ascertain the role the kink plays in the production of renal pelvic retention it might be well in doubtful cases to make a third exposure at the end of a half hour.

In the case shown in A of Figure 16 the patient's chief complaint was abdominal pain. The urological study revealed an infection of the right kidney with inflammatory dilatation of the ureter and renal pelvis and a well marked kink which we considered to be the chief factor in causing obstruction to the proper emptying of the renal pelvis.

Further inspection of the ureteropyelogram (Fig. 16) revealed a second factor in the shape of a stricture at the uteropelvic junction.

In the case shown in B of Figure 16 the pelvic retention and accompanying infection was due to a stricture at the uteropelvic junction alone. I have placed the two ure-

teropyelograms side by side because in one case there were two adjacent causes of obstruction viz a kink and a stricture while in the other there was no kink and only a stricture. These findings emphasize the necessity of routine ureteropyelography in all cases of renal infection as soon as acute symptoms have subsided.

The point which I wish to make in connection with ureteral kink is that one should not draw the deduction that when a kink is seen in the ureteropyelogram it is necessarily responsible for all of the symptoms. If however we have evidence of renal infection clinically and these are confirmed by the urological study of the case it is justifiable to state that the kink is responsible for the obstruction to the escape of the pelvic contents.

## ABNORMAL URETERAL IN FETUS

Under normal conditions the ureter arises from the most dependent portion of the renal pelvis (Fig. 4). The advantage of this form of uteropelvic junction from the standpoint of drainage is self evident. Although the renal pelvis is simply an expansion of the cephalic end of the embryonic ureter a faulty development may take place so that the ureter joins the pelvis at a higher point. This anomaly has been known for years and a fairly large number of plastic operations have been done to correct it.

My only object in bringing this anomaly before you is to direct attention to the possibility of recognizing it before operation through the aid of ureteropyelography. In three recent cases the chief complaint was recurrent pain over the kidney or one of the upper abdominal quadrants.

In all of the ureteropyelogram (Fig. 17) one can observe that the ureter passes either in front of or behind the lowermost point of the renal pelvis before entering the latter. The knowledge of the existence of such an anomaly is not only of great value from a diagnostic standpoint but also from that of treatment. Some form of plastic operation should be advised at an early stage before pathological changes due to infection endanger the success of such a procedure.

FRACTIONAL LIGATION OF THE COMMON CAROTID ARTERY IN THE TREATMENT OF PULSATING EXOPHTHALMOS<sup>1</sup>

By HARRY H. KERR, M.D., C.M., F.A.C.S., WASHINGTON, D. C.

**A**n exhaustive contribution to the subject of intracranial arteriovenous aneurism or pulsating exophthalmos has been made by Charles Edward Locke of San Francisco in the *Annals of Surgery* for July and August 1924. In this excellent article he reviews the history and summarizes previously reported cases. He contributes 3 additional cases bringing the total number reported in the literature up to 588.

In Locke's analysis of the results of treatment he comes to the following conclusions:

Carotid compression should precede any form of surgical intervention and the type of intervention should depend upon the results of these tests. If prolonged periods of carotid compression stop the bruit and do not cause signs of cerebral anæmia, beneficial therapeutic results are to be expected from ligation. If the carotid compression test shuts off the bruit yet gives headache or motor or sensory signs on the opposite side, a thorough course of compression is indicated before surgical intervention. If the carotid compression neither shuts off the bruit nor causes signs of brain anæmia, then a prolonged course of compression will not be of much value. Carotid ligation is indicated, but the surgeon will not be very confident of success.

In discussing the value of the various forms of surgical treatment he shows that the comparative results of common carotid and internal carotid ligation are about the same. Internal carotid ligation has been more frequently used of late while the method of common carotid ligation extends back to the pre-antiseptic days.

I am reporting my 3 cases because they were all treated by common carotid ligation; they were all treated by an original method of fractional ligation and they have all given as good results as could be expected.

The lesion in pulsating exophthalmos is an arteriovenous fistula between the internal carotid artery and the cavernous sinus. This

is most commonly the result of a fracture of the base of the skull. The fracture line passing through the anterior fossa tears the artery in its course within the sinus. The first of my 3 cases is of this type. A fewer number of pulsating exophthalmos cases develop spontaneously, probably from rupture of an aneurism of the carotid into the sinus. Aneurism of the ophthalmic artery within the orbit without rupture may produce pulsating exophthalmos. The third case of my series was spontaneous in origin. A much smaller number are produced by direct violence as from a gunshot wound. The second case in this series is of this type.

The natural history of pulsating exophthalmos leads eventually to complete blindness of the eye of the affected side. Not infrequently, however, the sufferers will commit suicide before this has occurred. The constant uncontrollable reiteration of the bruit from which they cannot escape leads them to take their own lives. It is the bruit from which they seek relief.

The pulsation may be controlled by ligation of the afferent artery or of the efferent vein. The former method, however, is much the best and may be accomplished by ligation of the internal carotid or the common carotid artery.

The question of the relative value of these two procedures depends upon two factors: the distance of the ligature from the lesion and the collateral circulation. Though ligation of the internal carotid does occlude the afferent current somewhat closer to the fistula, the difference between that and ligation of the common carotid artery is so slight that it can be dismissed. The principal collateral circulation of the affected artery, the internal carotid, is through its branches, the arteria receptaculi and the anterior communicating artery, which links it with its fellow of the opposite side in the formation of the circle of Willis.



Fig. 1. Stage of dissection of carotid artery.

The former collateral circulation depends upon a free anastomosis between its branches the *arteria receptaculi* and the middle meningeal branch of the external carotid artery of the same side. A collateral circulation re-established through this channel would pour arterial blood into the internal carotid at or near the lesion itself and would therefore be more likely to give unsatisfactory results or lead to a recurrence than if this collateral circulation did not exist.

The other important collateral circulation is through the anterior communicating artery, distal to the lesion and though there may develop some reversion of the circulation in the lesion it is unlikely that it would be of great moment.

I therefore feel that there is a definite advantage in common carotid ligation which not only occludes the affected vessel but also the vessel from which an anastomosis might bring recurrence. The danger of common carotid ligation lies in the possible embarrassment of the cerebral circulation of that side. This complication is escaped or avoided through the collateral circulation by way of the anterior communicating or vertebral arteries. Ligation of the common carotid does

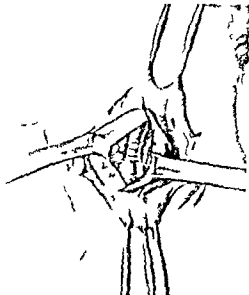


Fig. 2. The carotid artery ligated in place.

not interfere with this collateral. It is necessary, however, that the collateral cerebral circulation be given a chance to develop. This is best accomplished by my operation of fractional occlusion.

When my first case was referred to me by Dr F. I. Morrison on May 27, 1917, a review of the literature at that time seemed to indicate that ligation of the common carotid was more sure in its results than internal carotid ligation. However, the danger of cerebral anoxia with the possibility of a fatality or hemiplegia made it dangerous as a one-stage procedure. I tested this patient by carotid compression. I could produce symptoms of cerebral anoxia within a few seconds. By partial compression of the common carotid against the transverse process of the sixth cervical vertebra I could stop the pulsation of the eyeball and cause the disappearance of the bruit subjectively. Objectively, however, with this partial compression a bruit could be made out with the stethoscope. This partial compression did not produce any signs of cerebral anoxia even when maintained for a considerable period of time. It therefore seemed advisable to occlude the vessel partially, but large enough to ligate.

The patient, as therefore operated on under local anesthesia and a strip of fascia lata from the thigh was placed around the common carotid below the bifurcation. The artery was gradually constricted until the pulsation of the eyeball ceased but not to a sufficient extent to produce signs of cerebral anoxia. The patient being conscious was able to

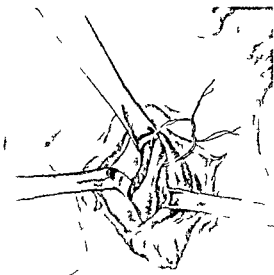


Fig 3 Double ligature placed easily to completely occlude the artery above the fascial band



Fig 4 (left) Photograph taken 2 years after operation of fractional ligation of common carotid artery. (right) Photograph showing exophthalmos in the left eye. The patient is shown in profile, looking towards the right.

Fig 5 Case 3 Photograph taken 2 years after operation showing exophthalmos in the left eye. The patient is shown in profile, looking towards the right.

co-operate in guiding us to a nice exactness of the extent of occlusion that could be made on the artery short of serious symptoms. When this had been accomplished the fascial band was sutured in situ with chromic catgut. It was found that the lumen of the artery had been reduced by about 50 per cent by the maneuver. The wound was then closed. The immediate results were gratifying in that the patient was not aware of the previous annoying bruit though it could still be heard with the stethoscope.

The character of the bruit on objective examination was decidedly altered. Three days after operation during the night and while lying on the affected side the patient was first aware of the return of the roaring. No untoward symptoms developed. Three weeks later the vessel was again exposed through the former incision and the common carotid artery ligated with a double ligature above the fascial band. The patient was discharged entirely relieved of his previous annoying symptoms.

A letter from the patient 5 years later states that (1) the sight of the affected eye is as good as that of the other (2) the movement of the eyeball is perfectly normal (3) occasionally following violent exercise there is pulsation of the eyeball to be seen (4) the noise is never heard except when he is lying with the affected side on the pillow in the quiet of the night and following too much exercise (5) he has never had any weakness or paræsthesia of the opposite side of the body.

The second case was referred by Dr William H. Wilmer in March 1923 with the history of having been shot with bird shot on the left side of the head and face the previous November. This accident destroyed the left eye which was immediately enucleated. A bruit developed shortly thereafter and then a pulsating exophthalmos of the remaining eye gradually developed.

Examination disclosed pulsation of the right eye and a bruit that was loud over the entire head and neck but loudest over the cheek and apparently of equal intensity on both sides. Motion of the eye was impaired in every direction except outward. The examination was otherwise negative. The sight in the right eye was 20/20. An X-ray showed many scattered bird shot in the scalp and in the face. One shot was inside the cranium at or very near the base of the sella turcica on the right side.

We were here confronted with a young man of 36 who had lost one eye and had developed a pulsating exophthalmos in the other eye. At this time the vision of the remaining eye had not been affected. Mindful of the satisfactory result obtained by fractional ligation in the first case I carried out the same procedure in this patient. A strip of fascia lata was again passed around the common carotid artery and the vessel was constructed about one half under local anesthesia. This maneuver completely obliterated the bruit both objectively and subjectively.

Following this first operation the condition of the eye slowly improved. The bruit was changed to a high pitched soft murmur heard only with a stethoscope. One week after operation power developed in the internal rectus and possibly in the superior rectus. Two weeks after the first operation under gas anesthesia the common carotid was doubly

ligated with Number 2 chromic catgut just above the fascial graft.

Examination 2 weeks after the second operation showed that the exophthalmos had disappeared with gradually returning power in the muscles. There was no pulsation over the eyeball. The bruit on auscultation could be made out faintly over the eye and opposite the external angular process but it was not heard by the patient except faintly in the dead of night. It was so distant and faint subjectively that it was not appreciated in the presence of any other sound.

Seven months later the bruit was about the same as after the operative procedure. It could be heard by the patient only when everything was profoundly still. All movements of the eyeball were normal. There was no pulsation felt or seen in the eyeball. Occlusion of the common carotid above the site of ligation did not affect the bruit but occlusion of the opposite common carotid or opposite internal carotid stopped it completely. It was suggested to the patient that the internal carotid of the opposite side might be ligated to effect a complete cure but she stated that the function of the eye was perfect and the bruit was so seldom heard that it was of no consequence and hence no reason for further operative procedure.

Both of these cases were of traumatic origin, the first from a fracture of the base of the skull and the second from the result of a gunshot accident.

My third case was in a woman 72 years of age and was probably of spontaneous etiology. She was referred to me by Dr. Wilmer, May, 1924. She gave a history of a fall 18 months before from which she was not rendered unconscious but from which she had some bleeding from the nose and severe headache. There was a prompt recovery. Six months after this while walking on the street she had a sensation of a sudden brilliant shaft of light above her eyes. She was made dizzy and nauseated. A similar attack occurred one week later. Three months later she first noticed a roaring in her ears. This persisted and grew gradually worse. She developed a pulsating exophthalmos one month after. She had been under Dr. Wilmer's care and had had digital compression and confinement to bed for about 6 weeks. There had been some improvement but not enough to promise any results. Her blood pressure ranged around 200.

The question of operation was discussed and finally resulted to a primary operation was per-

formed May 26, 1924 under local anesthesia. The common carotid artery was found extremely large and its lumen was reduced about 50 per cent with a band of fascia lata from the thigh. This amount of occlusion was sufficient to stop the bruit both subjectively and objectively but gave no cerebral signs. The wound was closed without drainage.

The bruit returned objectively but not subjectively a few days after operation. On the fifth day she was again conscious of the murmur when no other sound was audible. Three weeks after the first operation a definite pulsation in the eye returned. The roaring had increased somewhat. Complete digital occlusion of the common carotid produced a complete remission of dizziness after 15 seconds but after 45 seconds there was no advance of this symptom. In view of a blood pressure of 100 and arteriosclerosis it was thought wise to postpone further interference until a more satisfactory collateral circulation was established.

Under local anesthesia the artery was anastomosed on June 23, 1924 and doubly ligated with chromic catgut. This produced no subjective symptoms. Speech was not affected. There was numbness or tingling of the right hand and there was perfect control of that extremity. The bruit disappeared subjectively but it could still be faintly heard with the stethoscope. Four days after operation the patient developed a little thickening of speech and mental confusion. At this time the bruit which had been faintly heard over the left temple with the stethoscope entirely disappeared. There were no changes in the reflexes or the muscular power on either side. Sensation on the right side was unimpaired. The slight aphasia gradually improved.

On July 11 on careful examination the previous bruit heard over the left eye and temple had disappeared but a soft murmur could be made out under the left mastoid region. The patient was not aware of this noise. No pulsation in this region could be elicited and no swelling or mass could be felt. The murmur was not louder than at the site of ligation than at the point of maximum intensity. The condition of the eyes was normal and sight was perfect. The possibility of her having developed another aneurism in the vessels of the neck as considered as the new murmur was evidently not from her previous arteriovenous fistula.

A letter received 6 months after operation states that the condition of her eye is perfect. There is no pulsation but there are areas of a soft blowing murmur which evidently the bruit which had developed since operation.

# A STUDY OF MENSURATION

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In all studies of mensuration the search has been in regard to the more direct manifestations of the condition and the more obvious expression of alteration of the body process. Inasmuch as all function of the body are under control of the vegetative nervous system in one way or another it is interesting to consider the effect of menstruation upon the autonomic or sympathetic nervous system which controls the function of the heart, the intestines, the respiration, etc.

In the smooth muscle of the stomach and intestines as viewed through the fluoroscope and recorded by radiograph is a sensitive and mobile mechanism which readily registers the action and condition of the vegetative part of the human organism and is a manifestation of the action of the vegetative or autonomic nervous system, the vagus and sympathetic nerve apparatus. The vagus and its branches stimulate the muscles and motor mechanism of the stomach to action and inhibit the phincters. The sympathetic and its branches inhibit the smooth muscles of the stomach and intestine and stimulate the sphincter. Here in the delicate reactions of this large expression of smooth muscle as

viewed by the X-ray after a barium sulphate meal is the best opportunity to record the condition of the vegetative part of the human organism and the condition of the autonomic nerve supply in the movements and arrangement of the smooth or non striated muscle of the digestive tract. It is the largest unit of smooth muscle in the body so it is also most capable of movement and alteration. We have called the emanation and phenomena the *smooth muscle reaction*. In the course of a much larger study of many and varied conditions we have found that definite alteration in the haustra and arrangement of the intestines occurs as a result of vagus or sympathetic action or the preponderance of one or the other and a great number of examinations have been made to prove that these effects were constant under similar conditions of colloid and mineral metabolism and that they were not the result of mechanical filling of the intestine or other accidental circumstance. We have made experiments to prove that this alteration in the intestinal arrangement is the result of nerve action and that this action depends upon the vagus and sympathetic branches of the vegetative (autonomic or



Fig. 1



Fig. 2



Fig. 3

Fig. 1. Normal true l. smooth muscle reaction of the stomach and duodenum. Fig. 2. Normal true l. smooth muscle reaction of the stomach and duodenum. Fig. 3. Normal true l. smooth muscle reaction of the stomach and duodenum.

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Fig. 6 (left) Intermenstrual smooth muscle reaction of the colon in a case of dementia praecox.  
 Fig. 7 Menstrual smooth muscle reaction of the colon in the case of dementia praecox which was very much excited and worse at menstruation. Figures 6 and 7 are of the same patient.

considerable degree upon the presence of calcium in the blood and he found that the menstrual blood contained considerably more calcium than the circulating blood. We have also been able to produce in certain cases changes in the haustra and arrangement of the intestine similar to the condition of the intestine at menstruation by the ingestion and venous injection of various calcium salts. Blair Bell's methods of calcium estimation may be rather questionable as to accuracy but his conclusions as to the increase in calcium effect are in our opinion sound. Heape also came to the same conclusion in regard to the calcium wave. In a study of the calcium content of blood Malan and (4) examined the blood of 20 women through two or three menstrual cycles. He used the ash method and this may be taken as accurate. He found that there was a tendency of the calcium content to rise in 57 per cent of cases and in only 14 per cent did the calcium drop.

We studied menstruation in the most normally menstruating women we could find. The result of our investigation although carried over several months may be seen in Figures 1, 2 and 3. The illustrations here are made from thin paper tracings of the X-ray plate in the viewing box and so are accurate as to scale and detail. The condition of the smooth muscle reaction may be seen in Figure 1 8 days before menstruation. At this time the innervation was normal and inclined (indeed) toward sympatheticotonia. The intestine

was large and well placed and showed no stigmata of degeneration. The condition at menstruation is shown in Figure 2 where the intestine had become smaller, the haustra irregular and there was evidence of a preponderance of the stimulation of the vagus. This condition disappeared 5 days after menstruation (Fig. 3) and at that time the character of the smooth muscle reaction was again approaching normal.

A somewhat similar condition is shown in another patient who did not menstruate as normally as the first. This patient had greater evidences of toxæmia and a very profuse flow which lasted 4 days. She was subject to considerable disturbance at the time of her menstruation with acetone on her breath and in the urine and considerable yellowing of the skin in the last day of menstruation and afterward. In her intermenstrual period the condition of the smooth muscle reaction as shown in Figure 4 was that of somewhat upset innervation with a tendency toward preponderance of the vagus influence. This was shown by the caliber of the intestine, the irregular arrangement of the haustra and the rate and rhythm of the smooth muscle. The condition of the smooth muscle reaction one day after menstruation is seen in Figure 5 where there is marked narrowing of the lumen and a much greater irregularity of the haustra.

The condition of another patient is seen in Figures 6 and 7. This patient had dementia praecox and was subject to considerable ex-



acceleration of her condition at mensturation. She showed marked preponderance of the vagus influence during menstruation.

These illustrations are chosen from a considerable number and illustrate our belief that menstruation is a time of vagus preponderance and that this alteration can be seen and recorded in the smooth muscle reaction of the intestine. This is not surprising as the uterine muscle is supplied by the vegetative nervous system and any stimulation of the uterine muscle is quite likely to be associated with stimulation of the adjacent smooth muscle of the intestine associated with the same nerve supply. The longitudinal muscle of the uterus is stimulated by the vagus and inhibited by the sympathetic. The circular muscle is stimulated by the sympathetic and inhibited by the vagus. The intestine and heart react toward the same nerve influence so it is not surprising that the uterus and intestine react similarly.

Indeed it is quite possible that the preliminary cramp and pains of menstruation may be in some part due to intestinal cramp from vagus influence and that the constipation so often associated with menstruation is a spastic constipation due to contraction of the colon from stimulation of the pelvic branch of the vagus.

According to the law of summation of impulses there must be a considerable number of contractions of a hollow organ before pain results and this may explain the varying amount of pain at menstruation. For example a light induction shock to the kidney is not intense enough to cause any pain become unbearable by summation so the pain of smooth muscle or uterine muscle due to contractions of a hollow organ the stimulus of which may be only enough to cause contractions but with summation translated as pain or cramp.

One of us has been somewhat successful in lessening the pain of dysmenorrhea by the use of drugs and salts which inhibit the vagus or stimulate the sympathetic in order to lessen the vagus preponderance. The action of atropine for example is well known as decreasing the pains of menstruation. Atropine paralyzes the vagus and in this way reduces the vagus preponderance. We have made experiments which show the action of atropine upon the smooth muscle and its arrangement. Similarly drugs and salts which stimulate the vagus increase menstrual pain and flow. We hope to make the therapeutic results the subject of further study.

From the present study our conclusions are that menstruation is a time of vagotonia or vagus stimulation and that this can be shown in the smooth muscle reaction of the intestine as pictured by the X-ray. The wave of vagus preponderance begins from 8 to 2 days before menstruation reaches its height during menstruation and returns to the intermenstrual condition from 3 to 6 days after menstruation. There is some evidence that among other factors the vagus preponderance is in part at least due to the accumulation of calcium in the blood and tissues and that calcium is cast off at the time of menstruation. It is possible that some of the preliminary pains of menstruation are due to intestinal cramps from vagus stimulation. Drugs and salts which reduce the vagus stimulation relieve the menstrual pain.

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## THE BRONCHOSCOPIC TREATMENT OF LUNG ABSCESS

BY MERVIN C. MYERSON, M.D., NEW YORK

LUNG abscess is without doubt more prevalent today than in former years. Perhaps this is at least in part due to the increased number of tonsillectomies which seem to hold a prominent place in the etiology of this distressing condition. It might also be that a good many of our cases that were labeled chronic pulmonary tuberculosis are being properly classified as lung abscess. Further, the lung changes caused by the severe influenza epidemics must have some bearing upon the etiology of these conditions. Certain it is that lung abscess is better understood than it was a decade ago. It is a well recognized condition with a definite symptomatology and with a fairly well understood pathology. Although the major etiological factors are fairly well known, the mechanism of the production of these lesions is poorly understood. Work such as is being done by Mason (7) and Fetterolf and Fox (2) should help toward a better understanding of the etiology in at least some of the postoperative cases.

The general interest in lung abscess dates back to 1912 when Richardson (13) first reported lung abscess following tonsillectomy. On this subject he was followed by Bassim (1) in 1913, Manges (6) in 1916 and numerous others since. Stress is laid upon the relative frequency of pulmonary complications following operations upon the upper air passages. Lord (4) reports 98 of 227 cases of lung abscess as due to operations upon the upper air passages. Whittemore (14) 66 of 100 cases. MacKenzie (5) 11 of 67 in Hedblom's (3) series of 692 cases 146, 21 per cent were postoperative, while of these 48 followed tonsillectomy. Of 96 abscesses seen by the writer 16 followed tonsillectomy and 1 followed operation upon the jaw. In a statistical study Moore (8) reported 202 lung abscesses occurring in approximately 450,000 tonsillectomies, an incidence of about 1 in 2,500.

Lung suppuration may be produced in one of several ways according to our present conceptions by aspiration by means of the blood

stream by extension from neighboring structures and by trauma to the chest wall or the thoracic viscera. A fifth manner of production of lung abscess might be the suppuration which follows the condition recognized as unresolved pneumonia.

The frequency of the tonsil operation and the consequent interest in lung abscess following this operation justifies at least passing comment on the probable mode of production of the abscess in these cases. In the discussion of post tonsillectomy abscess aspiration and embolism are the modes of production which require consideration. Both routes of infection have their advocates. As a result of his bronchoscopic studies (9 and 10) of tonsillectomy under general anesthesia and because of his interest in the care and treatment of these lung abscess cases, the writer has been led to favor aspiration (11) as the principal route of infection in post tonsillectomy suppurations.

About 10 years ago Yankauer began to irrigate lung abscesses with the special cannula which he then devised. Shortly afterward Lynch popularized this treatment. More recently Jackson and his associates have taken up this work.

A review of 32 cases of lung abscess which were treated systematically by the writer is here given. This does not include some 60 or more cases with which he came in contact on the various services of the Kings County Hospital and the other institutions the material of which was available to him. These cases were almost all subjected to bronchoscopy, but not systematically treated and are therefore not included in this review.

A glance at Table I shows the variety of etiological factors which we encounter in these cases. It also demonstrates that many cases are designated as pneumonia when the true etiological condition is not known.

The ages range from 3 to 55 years. The duration of the disease has been found to be from 2 weeks to 14 years.



Fig 1 H N m l ge 35 lscs rht lo er lobe  
f ll g pneum

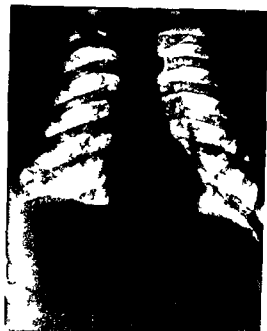


Fig 2 H N sam p t t 4 mo th ft l st broncho-  
sc p t atm t

TABLE I—ETIOLOGY AND RESULTS OF  
TREATMENT

	C	Im	Im	Im	D	d
	ed	pro	ed	pro	ed	
Pneumoni	9	2	7			
T n llect m	6	3	3			
Infl nza		1				
Fra t ed rib	1					
F gn body	2	1				†
J w—ether	1					
Appe dect my					1	
C rin m —eth						
Fra t df m						
Amp t to						
Br cho-p m nia			1			
D etc i m	1					
Obscure	4					1†

\*On pa p pared for opera so urinal cur  
†Child mu ple pap ll msta of laryn in by on be ll wed t f ll  
into rht br b (mistak diagno d ph b rux) bicesa igh middle  
dl w lobes T beo m Dur so 3 y  
1 Ag 7 dur to years 1 l id w ry fus d

The incidence of lower lobe involvement is greatest and the right side shows a higher incidence than the left (Table II)

The number of bronchoscopies in a given case is of no special significance because there are many factor that influence results. These depend not only upon the pathology and treat

TABLE II—LOBES INVOLVED

	Right	Left
Upper	3	6
Middle		
Low	4	
Middle d		
	9	13

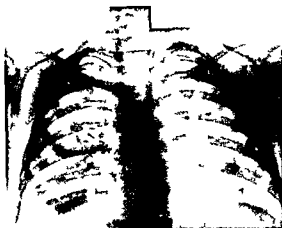
ment indicated but also upon the disposition and co-operation of the patient and frequently of his family. Patience and endurance on the part of both the bronchoscopist and those concerned in the treatment is essential. Figures and percentage mean very little in the consideration of these distressing conditions. The fact that a patient is reported as improved does not mean that he cannot develop an acute exacerbation of his chronic condition and die in a very short time of toxemia. The true effect of any given treatment is to be measured by a conception of the local pathological process.

The treatment of suppurative lung disease resolves itself into expectant and non-expectant.

The expectant consists of posture, antituberculous regime and vaccines.



F 3 H G m l ge 40 at r ht l er l be  
 foll g th ope t on upo j Roentg m h  
 m ppin f bse r ft m t lod f l h b th  
 of b m th nd !



F 4 T K male a e 4 post t n llectomy bce s  
 r, ht l l be

tion Nature does the rest In the second stage through (1) collapse and obliteration of cavity and (2) through replacement fibrosis

The second stage is cared for purely by nature's handwork The main prerequisite for a cure then is a collapsible cavity and this is true regardless of the type of cure The aeration overcomes the odor by creating an unfavorable condition for the anaerobic bacteria The irrigation thins out the thick viscid and tenacious exudate so that the suction apparatus will accomplish its aspiration and removal from the lung bed and bronchial tree The semidiagrammatic drawing (Fig 6) shows the relation of the bronchoscope and irrigating tube to the branch bronchus that is emptying the pus into the main bronchus and to the lung abscess The irrigating tube and the aspirator do not enter the actual abscess cavity in the lung but do attack the abscess by way of the branch bronchus which can be seen emptying exudate into the main bronchus

Of the chronic cases or non curable cases a very large majority are markedly improved This improvement may last a very long or a very short time according to the chronicity and size of the lesion which can to some extent be gauged by the clinical behavior of the patient and the duration of the disease For greater accuracy in mapping the cavities the introduction of bismuth in oil into the lung after the method of Lynch is of advantage The use of bismuth powder after the method

The non expectant consists of bronchoscopy artificial pneumothorax and surgery—(1) collapse and (2) removal Of the non expectant types of treatment bronchoscopy in the hands of the qualified worker is the safest the least uncomfortable and the simplest form of treatment

There are roughly two classes of suppurations which come for treatment the acute and chronic cases In the acute cases it has been the writer's experience that a cure can be obtained with the bronchoscope In the chronic cases alleviation of symptoms and improvement is usually the case but cure has not been encountered thus far Therefore I have come to regard these cases as cures and non cures Let us for the moment consider how bronchoscopy aims to accomplish a cure in the acute cases

Bronchoscopy aims to establish a cure in the following manner In the first stage through (1) aeration (2) irrigation—thinning of secretions and (3) aspiration—evacua

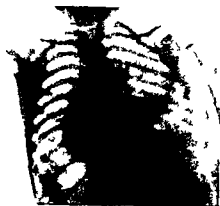


Fig. 5. T. K. N. (The case of T. K. N. is a case of relapsing fever.)

Jackson's of particular value in outlining the bronchial tree.

Cases of moderately long standing show the following clinical picture. There is cough profuse expectoration the sputum is very offensive in its odor there is clubbing of the fingers some loss of weight an increased pulse rate a slight elevation of temperature and weakness. There may or may not be hemoptysis. As was said before all lung abscesses react favorably to treatment immediately after bronchoscopy. The duration of this favorable response to treatment is what determines whether a given case can be sufficiently helped by bronchoscopy to make it worth while to continue the treatment or whether that case should be turned over to somebody else for pneumothorax or appropriate surgery. Marked improvement for several days a sufficient justification to continue irrigations. The favorable response to treatment brings with it a marked lessening of the frequency of the cough the putum is decreased in amount the odor is no longer present there is a recession of the clubbing of the fingers the pulse rate and temperature approximate normal and the patient is brighter and more cheerful. He soon gains in weight and strength.

It might be well to emphasize here the extreme importance of proper advice and instruction to these improved patients. They must keep free from upper respiratory infections in order to enjoy a measure of good health

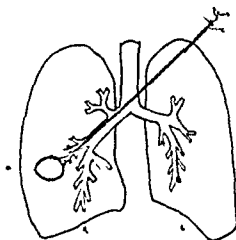


Fig. 6. Diagram of relation of bronchoscope and irrigator to abscess area. Abscess area is indicated by the arrow.

for the introduction of infection into the respiratory passages of these patients means exacerbation of the abscess and serious illness which is sometimes fatal.

In the consideration of the non-curable cases it is at once evident that it is very unlikely that an abscess of several years duration will lend itself to cure by bronchoscopic irrigation. This is because there is so much fibrous tissue in the wall of the cavity that the cavity is truly a fixed one and a fixed cavity will not collapse of its own accord. In addition to the fibrosis in the periphery of the abscess cavity there is a greatly thickened and adherent pleura particularly in those cases in which the abscess is at all superficial.

It is doubtful whether cures that are reported of cases of many years duration are reported upon a basis of subsequent clinical behavior for such a cure is contradictory to our knowledge of pathology. There are very few abscesses which will not lose their odor and react so favorably to give the mistaken idea of a cure immediately after irrigation. The anatomical and pathological change necessary for a cure have not been brought about and cannot be brought about in this type of case. Those patients who are not helped very definitely by bronchoscopic treat-

ment should be referred to the surgeon. The risk involved in continuing treatment in this type of case is too great. These patients lose ground and as a result of their lowered resistance are prone to infection of the respiratory tract with its resultant pneumonia and sepsis and frequently termination. These patients are liable to have hemorrhages and occasionally may develop metastatic processes in the brain.

However in cases of long standing the patient can be kept comfortable and at times free from symptoms as a result of bronchoscopic irrigations.

In the suppurations which are not of recent origin the first bronchoscopy pays particular attention to the condition of the bronchial tree. At this time obstructions in the form of granulations are noted and overcome. The branch bronchus which is emptying the exudate into the main bronchus is entered with the special irrigation and suction tube (12). As the calibrated end is about three quarters of an inch longer than the aspirating tube it makes possible additional approach to the area of suppuration and thus a more complete irrigation is obtained. For irrigation weak iodine solution as originally advised by Yankauer saline solution acriflavine 1:8000 have been used. For instillation oil of eucalyptus in sweet almond oil pine needle oil in sweet almond oil iodine in oil in varying strengths has been used. The writer questions the special value of any given irrigating medium. It would seem that the mechanical flushing and cleansing is the main factor in the irrigation. Whether instillation of medicament is of value is also a question of doubt in the minds of some.

If we bear in mind what has been said concerning the chronic abscesses which until the present time I have called the non curable cases it is at once evident that bronchoscopy offers some hope of cure in abscesses of short duration in which not too great an area is involved.

A glance at Table III showing the cured cases demonstrates the importance of instituting treatment early. When acute abscesses are first seen they are aspirated only and should never be irrigated because

TABLE III—CURED CASES WITH DETAILS OF INTEREST

	Sex	Age	Etiology	Duration	Lobe	Irig		
						N	First	Last
I H	F		Tubercle my	mos	R L	8	J 9	M 9
H N	M	38	Lob P m	5 wk	R L	8	M 9	M y
J F	M	33	Infl F m	wk	R M		Apr 9 4	M y
T K	M		Tubercle my	3 days	R L		J ly 9 4	A g 4
F M	M	55	Infl 2a	3 k	R L		F b	9
N L	F	3	Tubercle my	3 k	LU		N	9 4

1. The infection may be spread since the process may not yet have become sufficiently localized for aspiration.

2. In early abscess nature's protective barrier is delicate and nothing should be done to interfere with it.

In these cases at the time of the first bronchoscopy it will be found quite sufficient simply to aspirate.

### CONCLUSIONS

In conclusion I would say that bronchoscopy deserves a trial for the reasons enumerated above. This procedure which is done without anaesthesia in children and with a small amount of local anaesthetic in adults is free from injury of any kind to the individual when performed by skilled endoscopists. When properly performed it is not as formidable as the profession has been led to believe. To day in the hand of qualified workers this treatment has no mortality and should be considered before surgery is undertaken as surgery in most cases is deforming and is not without danger to life.

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## APOPHYSITIS OF THE OS CALCIS

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**I**NFLAMMATION of the cap like epiphysis at the posterior portion of the os calcis is called apophysitis. This term was first used by Sever. The condition is fairly common. Its importance lies in early recognition and proper treatment which will prevent a certain degree of permanent disability. The literature on this subject is very brief. In many textbooks on orthopedic surgery the condition is not mentioned. The most recent articles are by Allison and Fairbank. Sever reported 5 cases, Kurtz 3, Allison 2, and Fairbank 14 cases.

## PATHOLOGY

According to Brerter and Waters the separate center of ossification of the posterior extremity of the os calcis appears at the tenth and unites at the eighteenth year. It is to this structure that the tendo achillis makes the attachment for the powerful gastrocnemius, soleus and plantaris muscles. The epiphysis is therefore at a great mechanical disadvantage. The period of greatest hyperemia which probably begins a year before the epiphysis is demonstrable and ends at about the fourteenth year is the critical time in the life of the apophysis. It is then that changes in circulation and local internal and

external influences cause marked alterations. These changes are in the nature of epiphysitis and osteitis and may go on to destructive lesions. Interference with the growth of the posterior portion of the os calcis results and is serious because of the importance of this region in propelling the body in locomotion.

## ETIOLOGY

The etiology of apophysitis is still under discussion. The various factors to be considered are the following:

1. Trauma may be internal or external. By internal trauma I meant the strain and stress applied to the apophysis by the triceps surae group of muscles through the tendo achillis.

2. Infection is probably not the primary cause.

3. Clandular disturbance may be a factor in certain cases in a manner similar to slipped epiphysis in the hip.

4. Metabolic disturbance is probably a factor.

5. Circulatory alterations are undoubtedly very important and their relation to trauma may be very close.



Fig. 1. Roentgenogram of the heel of a child with apophysitis of the posterior epiphysis of the os calcis.



Fig. 2. Lateral view of the posterior epiphysis of the os calcis after operation for apophysitis.





Fig. 3. N. T. July 27, 1923. Anterior view.

Fig. 4. N. T. August 3, 1923. Lateral view.

Fig. 5. N. T. August 13, 1923. Anterior view.

Sever's 5 cases included 3 girls and 2 boys aged 7, 12, 10 and 6 years. They were as a rule overweight, strongly muscled and active. He quotes Litch to the effect that the epiphysis of the os calcis may develop from 1 or 2 centers that it appears during the ninth year and unites before puberty or soon after. Sever, however, believes that the center appears during the seventh year and in larger children the epiphyseal development is earlier and more marked. Apophysitis never occurs after puberty.

The writer believes that apophysitis is a condition analogous to Legg's disease in the hip. Osgood Schlatter's disease in the tibia, Koehler's tarsal scaphoiditis, Freiberg's infraction of the metatarsal head and Scheuermann's kyphosis dorsalis juvenilis or vertebral apophysitis. He also believes that the important factors are local trauma, external and especially internal plus local circulatory disturbances affecting the apophysis at its critical period of growth. He agrees with Allison who states that the

changes in apophysitis and Legg's disease are similar. He believes, however, that the condition first described by Osgood as occurring in the upper tibial epiphysis is a more pronounced analogy because in both cases there is an epiphysis which serves as an attachment for a large tendon which is acted upon by a powerful group of muscles.

#### SIGNS AND SYMPTOMS

There may be a history of injury but this is not constant. The child might have been running on hard pavements wearing sandals or tennis shoe. The onset is insidious. Limp is usually the first symptom and may or may not be accompanied by pain. Pain is dull and localized to the affected area. It is marked while wearing shoes with heel. Pressure by the shoe aggravates the pain. Swelling is present. There may be obliteration of the normal outlines due to thickening of the tissues. Signs of acute infection are not prominent. Tenderness may be present over the posterior as

pect of the heel for weeks or even months. The child does not permit stretching of the Achilles tendon which accounts for the equinus position of the foot and the limitation of dorsiflexion. There is a disinclination to complete the full step. Slight pronation may be present.

Roentgenograms made in anteroposterior and lateral projection reveal irregularity of the apophysis with thickening in all directions. There may be clouding or partial obliteration of the epiphyseal line.

#### DIAGNOSIS

The direct diagnosis is based upon the history and findings enumerated above.

In the differential diagnosis the following conditions must be born in mind: achillobursitis, tenosynovitis, bursitis between the tendo achillis and skin, calcaneal spur, tuberculosis and pyogenic infection.

*Achillobursitis* or inflammation of the bursa between the tendo achillis and the os calcis reveal a more superficial and localized inflammation. The roentgenogram is negative for pathological conditions of the bone.

*Tenosynovitis* of the achillis is characterized by pain referred to the tendon and by palpable crepitus on movement. The roentgenogram is negative.

*Bursitis* between the Achilles tendon and the skin is a very superficial inflammation usually the result of pressure of the shoe and should be easily determined.

*Calcaneal spur* is rare in early adolescence and is usually found on the inferior internal aspect of the os calcis. The area of sensitive ne should determine the diagnosis. The inflammation is associated with the attachment of the plantar fascia instead of the tendo achillis.

*Tuberculo*sis of the os calcis is usually in the anterior portion of body and not in the posterior region. Other evidences of tuberculosis are absent in apophysitis and the roentgenogram will aid very materially in the differentiation. There is no bone atrophy in apophysitis.

A pyogenic infection would produce more marked inflammatory reaction with destructive osteitis.

#### PROGNOSIS

The prognosis is excellent if proper orthopedic treatment is instituted. The course is comparatively short and may vary from a few weeks to several months. The condition may recur as a result of over activity or trauma. Cure is effected when consolidation occurs between the os calcis and the apophysis.

#### TREATMENT

The treatment is simple. The indications are to relieve the tendo achillis of strain and to prevent weight bearing on the os calcis.

The most satisfactory treatment consists of the application of a plaster cast extending from the toes to just above the knee in such a manner as to hold the foot in very slight equinus thus relaxing the pull of the triceps and the knee in very slight flexion. Two crutches and a 2 inch block under the heel and sole of the opposite shoe (in unilateral cases) aid in locomotion. This cast should be removed in 4 weeks and another immediately applied extending from the toes to the garter line holding the foot at a right angle but with no varus or valgus. At the end of 4 more weeks this cast should be removed and a high lace shoe with a 3/4 inch cork lift for the heel worn. Weight bearing with the aid of crutches should be carried out for another 2 weeks. Contrast baths, baking or diathermy should be employed during this period.

During the course of treatment emphasis should be placed upon direct sunlight and proper food. If there is any glandular disturbance proper therapy should be instituted.

If the case is so mild that the above treatment is not indicated it will be sufficient to elevate the heel, remove the counter of the shoe and insert a pad of felt or ponge rubber in the heel. The heel may be protected by adhesive strapping and the pronation corrected. Rubber heels should be worn.

A report of a case follows:

A T. white boy age 11 years sent to St. Luke's Hospital July 27, 1923 because of pain and tenderness in the right heel. One month previous to admission the patient noticed a pain in his right heel. This appeared one morning and increased in severity during the course of a few hours. Tenderness and swelling were also present at the outset. The area was incised with only temporary relief and dress-



FURTHER OBSERVATIONS OF INTRACRANIAL HÆMORRHAGE IN THE NEWBORN<sup>1</sup>

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**D**URING the past 10 years renewed interest has been aroused in the subject of acute intracranial hæmorrhage in the newborn. The valuable clinical contributions of Siddbury (19) Brady (3) Green (11) Strachauer (20) Thurnfest (4) Conkey (5) Monroe and Lustice (16) and the careful postmortem studies of Warwick (1) Capon (4) and Barnett (1) have all recognized and emphasized the increasing importance of this intracranial complication as a factor in the well being of the child not only as to life itself but to its future normality mentally and physically. Within the past 6 months Schwartz (18) of Berlin has stated that the pathology of the first month of life is completely dominated by the birth injuries of the brain and Fischer (10) of Basel has written that his postmortem observations at the Institute have convinced him that the 10 per cent of deaths during the first month are chiefly due to cerebral birth injuries. Huenekeins (12) in a recent article states that the recognition of cerebral hæmorrhage of the newborn is a most neglected phase in their care and yet it is a most important one.

Until recent years the study of intracranial hæmorrhage in the newborn has been limited chiefly to postmortem examinations of the extreme acute types of intracranial hæmorrhage of sufficient amount to cause the death of the baby and producing clinically well marked signs of stupor to the degree of unconsciousness refusal to nurse and even convulsive seizures or if an intracranial hæmorrhage of milder degree was suspected owing to the presence of slight muscular twitchings difficulty in nursing and a mild drowsiness then the use of various drugs to increase the coagulability of the blood and thus aid in lessening the danger of further hæmorrhage and finally the study of the chronic forms of intracranial hæmorrhage in the newborn—first suggested by Deni (9) in

1866 Billard (1) in 1868 and Cruveilhier (6) in 1869-75 by Little in 1843 (13) and in 1862 (14) by Sarah MacNutt (15) in 1885 and by a rapidly increasing group of observers during the past 15 years. The pathology of 75 per cent of these chronic cases of cerebral spastic paralysis associated with mental retardation of varying degree was ascribed by Little in 1860 and confirmed by MacNutt in 1885 as being due to an intracranial hæmorrhage at the time of birth yet the significance of these postmortem studies was practically overlooked in the literature so that the frequency of intracranial hæmorrhage in the newborn was commonly considered to be limited to those babies dying within the first 2 weeks after birth and to those supposedly rare case of milder intracranial hæmorrhage making apparently excellent recoveries both of life and of future normality with and without any definite medical treatment.

We have been impressed by the frequency of certain clinical signs such as drowsiness difficulty in nursing and muscular twitchings even to the degree of convulsive seizures presented in the birth histories of a large series of selected cases of cerebral spastic paralysis and as the pathology in these chronic cases has been demonstrated at operation or at autopsy as being due to an intracranial hæmorrhage most probably at the time of birth and as in a series of 46 acute cases of severe intracranial hæmorrhage in the newborn which had been examined in consultation during the ten year period of 1913 to 1923 with accurate clinical operative and postmortem records of the findings one of the writers (Sharpe) became more and more impressed that possibly intracranial hæmorrhage of varying degree in the newborn was a more common complication of birth than is ordinarily believed and that possibly the signs in the milder cases were being overlooked as of no real significance until months and years later when the condition had be

come a chronic one. Naturally any treatment of these chronic cases can be directed only toward an improvement of the condition in the ideal time for treatment is during the acute stage when the blood itself in fluid form may be drained either by the repeated lumbar punctures producing spinal drainage or in the more extreme cases by the modified subtemporal operation producing cranial drainage. In order to ascertain the frequency of intracranial hemorrhage in the newborn and to determine if possible the associated clinical picture is presented by these acute cases in which an intracranial hemorrhage of varying degree is present. Permission was obtained in January 1923 to perform a series of lumbar punctures upon consecutive newborn babies at the City Hospital Welfare Island, New York City, upon the services of Doctor J. A. Dorman and Walter Ward. To them and to Doctor Charles C. Child the writer desires to acknowledge their indebtedness for making possible the carrying out of these cases.<sup>1</sup>

In this fifth series of 100 consecutive newborn babies upon whom a lumbar puncture was performed within 24 to 48 hours after birth, bloody and blood tinged cerebrospinal fluid was obtained in 6 cases that is 6 per cent. In 19 of these 100 newborn babies lumbar puncture was not performed in 9 the so called cry tap occurred or the spinal canal was not completely entered, three were stillbirths, two were considered too feeble to be subjected to the possible allied risk or shock of a lumbar puncture and 5 died before a lumbar puncture was performed. In 2 cases the puncture was contaminated with blood due to faulty technique. The males numbered 54 and the females 46 being practically the same as in the preceding series. In this fifth series however only 39 were first children and as large a number as 44 were of the negro race, possibly factors in the lower incidence of intracranial hemorrhage in this race. Three of the babies having bloody cerebrospinal fluid were of primipara.

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All 6 cases having bloody cerebrospinal fluid were males 5 white and 1 negro. Two were left occipito-anterior presentation. Two were premature one was a breech and the other was a low set deep baby. One premature baby from whom three lumbar punctures drained bloody cerebrospinal fluid died on the fourth day and no autopsy was performed. In three babies the cerebrospinal fluid was yellow in two (with 6-8 red blood cells to a field) and blood tinged in one and it became clear after one puncture. Four lumbar punctures drained bloody cerebrospinal fluid from one baby, the Wassermann test of whose mother was 4 plus. This child was transferred to another ward for treatment and further lumbar punctures were not possible. The sixth case had bloody cerebrospinal fluid at three lumbar punctures. This baby became jaundiced on the third day but the cerebrospinal fluid became clear 3 days after the appearance of the jaundice.

The labor was right occipito-interno in 4 and left occipito-anterior in 55. Forceps were used in 8. Breech extraction in 4 and prolonged labor in 4. Of the 6 babies having bloody cerebrospinal fluid there were no definite signs of its presence and it would have been overlooked if the routine lumbar puncture had not been performed. The premature baby did have a weak cry and the baby with the lactating mother did have to be re-uscitated but 4 other babies in the series required re-uscitation and their cerebrospinal fluids were clear. Ten babies had the cord about their necks but in none of them was bloody cerebrospinal fluid present.

The intracranial pressure as registered by the spinal mercurial manometer was normal (5 to 8 millimeters) in 47, increased (9 plus millimeters) in 9, below normal (5 minus millimeter) in 5 and the test of lumbar puncture was not performed in 10. In the 6 bloody cases the pressure was above normal in 3, normal in 2 and below normal in 1 (one of the premature babies that died). The fontanelles were flush in 6, bulging in 23, depressed in 43 and not recorded in 8. Of the six bloody cases 3 were flush, were bulging and 1 depressed (one of the premature babies). Eight mothers disclosed a positive

Wassermann reaction of their babies 5 had clear cerebrospinal fluid one bloody cerebrospinal fluid one died before lumbar puncture and an autopsy did not disclose an intracranial hæmorrhage and in one the lumbar puncture was not successful Of the 3 still births one autopsy was negative for intracranial hæmorrhage and autopsy was refused in the other two cases

The coagulation time of the blood was within normal limits for each one of the six cases having bloody cerebrospinal fluid being respectively  $5\frac{1}{2}$  minutes 5 minutes  $3\frac{1}{2}$  minutes 6 minutes  $5\frac{1}{2}$  minutes and 4 minutes Not one baby in the entire series had a clotting time over  $7\frac{1}{2}$  minutes These observations would tend to confirm the belief of Ehrenfest (7) who states that undue stress is being laid upon the hæmorrhagic diathesis and that the wide pread significance of artificial mechanical and physiological trauma incident to birth is being overlooked

The technique used in these series of newborn babies has been as follows A lumbar puncture needle of the size and caliber of the ordinary intramuscular needle was inserted into the fourth lumbar interspace—the baby being flexed in the horizontal position by a nurse so that the head and knees were approximated and care was taken to have the spinal canal and the median line of the head on a level and parallel with the table Upon entering the subarachnoid space successfully the small rubber tube attached to the spinal mercurial manometer was connected with the puncture needle and a careful reading of the pressure was made the child being quiet and the acute anterior flexion of its body being relaxed The opening of a stopcock on the needle now permitted cerebrospinal fluid to escape into a sterile test tube The character of the fluid was noted and if clear and under normal pressure (4 to 8 millimeters) 2 cubic centimeters for laboratory examination were drained into the test tube If under increased pressure (above 8 millimeters) and especially if bloody blood tinged or yellow then an amount was allowed to escape slowly until the pressure registered by the manometer became normal care being taken not to permit the fluid to escape rapidly in a quantity large

enough to lower the pressure below normal Thus it was possible to estimate accurately just how much fluid could be drained safely and with no danger of medullary pressure or vascular complications If the fluid was bloody to any degree then an immediate second puncture was performed in the third lumbar interspace merely to confirm the presence of blood in the cerebrospinal fluid of the first puncture Blood due to the puncture itself technically is differentiated by the fact that this extraneous blood streaks the cerebrospinal fluid as it drops from the needle and is not homogeneously mixed throughout the cerebrospinal fluid in the test tube besides the second lumbar puncture is another control of the findings both of the blood and pressure is disclosed According to the pressure and blood consistency of the cerebrospinal fluid a lumbar puncture of spinal drainage was performed in our first series every 4 hours until the cerebrospinal fluid became clear and under normal pressure In the later series however the interval between drainage punctures was made every 12 to 4 hours and in the last series of test cases a puncture of spinal drainage was being considered even as frequently as every 6 hours according to the pressure and the blood consistency of the cerebrospinal fluid That is the method of lumbar puncture was used not only as a means of diagnosis but more as an active method of drainage of the free blood in the cerebrospinal fluid in the hope that clotting of this free blood could be entirely avoided so that there would not remain unabsorbed any hæmorrhagic clot and thus possible organization residue and future blockage of the normal absorption of the cerebrospinal fluid

The following case history is rather instructive

First born full term baby weighing 6 pounds 4 ounces was delivered as a breech at 7 a.m. November 12 1924 Resuscitation was necessary One hour after birth a small quantity of blood was vomited no melaena was present and the meconium was normal The baby remained in a very drowsy condition for several hours with rather labored respiration and upon the appearance of muscular twitchings about the right orbit an intracranial hæmorrhage was suspected At consultation 6



In this series as in the preceding four series it has been very surprising not to have found a lengthened coagulation time of the blood at least in several of the 46 cases that had bloody cerebrospinal fluid in the total series of 500 newborn babies. The Rodda (17) method was used and although the bleeding time might still be lengthened and yet the coagulation time apparently be within normal limits the great importance formally ascribed to hæmorrhagic disease of the newborn as the etiological factor in intracranial hæmorrhage of the newborn seems unwarranted—at least in these series of observations. Two of the 6 babies having bloody cerebrospinal fluid in this series were premature and as in the preceding four series it does seem that these premature babies are more liable to this intracranial complication of hæmorrhage than are the ones born at full term. Whether this is due in part to the walls of their supracortical veins not being sufficiently developed and therefore not so resistant to the dilatation and venous congestion associated with birth and rupturing more easily can only be surmised as a possible explanation. Breech extraction in this series is again a frequent cause of intracranial hæmorrhage in the newborn and prolonged labor when low forceps are used as a last resort instead of being used early is also a definite etiological factor.

In the preceding series the proportion of males to females has been about the same as an equal number. The mothers have been primiparous in about one half of the cases. In this series however although the males about equal the females in number only 39 were first children and as large a number as 44 were of the negro race. As suggested above these factors may account for the lessened incidence of bloody cerebrospinal fluid in this series as compared with 9 per cent, 13 per cent, 10 per cent and 7 per cent in the 4 preceding series respectively.

The clinical signs have been most meager and if a routine lumbar puncture had not been performed it is doubtful if the condition of intracranial hæmorrhage could have been even suspected in many of the cases. Difficulty in nursing and prolonged drowsiness were the two most common signs.

Only 4 lumbar punctures were necessary in this series to obtain clear cerebrospinal fluid as compared with 7, 8 and even 9 punctures in three cases of the preceding series. Possibly the free blood as disclosed by lumbar puncture would have been entirely absorbed by the natural means of absorption of the cerebrospinal fluid through the foramina in the wall of the supracortical vein through which over 80 per cent of the cerebrospinal fluid is normally excreted and the remainder into the sinuses. Pacchian bodies etc. Yet it does seem rational that the additional spinal drainage of repeated lumbar punctures would aid in the complete absorption of the free blood which might be in an amount too large to be entirely absorbed by the natural means of absorption—in which case there would be the great danger of the organization residue of hæmorrhage causing a future impaired child both physically and mentally. The added risk of a lumbar puncture appears to be practically nil in the babies of these series of observations. On the other hand in babies of low vitality and especially if premature or babies in the state of severe shock no lumbar puncture should be performed nor indeed any prolonged examinations made that might increase the shock. As in the treatment of acute brain injuries in adult if the patients cannot survive the shock of the cranial injury surely no prolonged examinations tests lumbar puncture and by no means cranial operation will aid them. If such patients do recover life even with such treatment during this period of shock then they recover in spite of the treatment. Patients in shock with intracranial hæmorrhage of the usual type supracortical venous bleeding cannot continue bleeding intracranially to any large extent because very quickly the resulting increased intracranial pressure will become greater than the lowered general arterial blood pressure of shock and therefore the intracranial hæmorrhage then lessens. As the baby recovers from the acute condition of shock then the general arterial blood pressure rises so that it again becomes possible for intracranial venous hæmorrhage to occur unless coagulation of the blood of the ruptured supracortical



veins is now of sufficient degree to prevent continued venous oozing

The use of blood coagulants such as calcium lactate mother's blood and hemostatic sera etc may be of value to increase the coagulability of the blood even if the coagulation time is normal. However to limit the treatment of these cases of intracranial hemorrhage in the newborn merely to increasing the coagulability of the blood with no treatment directed to drain from the cerebrospinal system the blood already escaped from the ruptured vessels seems to us not all we could hope for. If the child recovers then there is the great danger of future cerebral impairment. It is our opinion that the more rational treatment of the acute cases would be a combination of both methods increasing the coagulability of the blood to lessen further hemorrhage and the aiding of the normal means of absorption of the blood already free in the cerebrospinal fluid by repeated lumbar punctures of spinal drainage and in the rare extreme cases even craniotomy by modified subtemporal decompression. Naturally the earlier the true intracranial condition of hemorrhage in these cases is recognized and its appropriate treatment instituted while the blood is still in fluid form just so much better is the prognosis both as to life and to future normality. Theoretically the use of blood coagulants alone in the treatment might in certain cases of large hemorrhage produce a too rapid coagulation of the blood already escaped from the supracortical veins and lying upon the cerebral cortex so that this blood clot

could be less easily absorbed by the natural mean of absorption thus defeating in part the object of the treatment.

Apparently then the treatment in these cases should be a combined one—increasing blood coagulation and draining early whatever hemorrhage has already occurred in its fluid form both removing the free blood from the cerebrospinal system and at the same time diluting and lessening the blood consistency of the cerebrospinal fluid so that thus free blood clots less rapidly thus facilitating its continued absorption by the natural mean of excretion.

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## THE INTRACRANIAL COMPLICATIONS OF POSTERIOR SINUS INFECTIONS

## REPORT OF AN UNUSUAL CASE WITH AUTOPSY FINDINGS

B E B FINK I t D M D CHICAGO

F m th Cook County Hospital Srv f D C g B H D 15 g ry 4 th D pa m t f P th l gy nd B ct m l gy Chc g C H g f

THE development of our knowledge of the intracranial complications of accessory nasal sinus disease has formed one of the most interesting chapters of rhinology both clinically and pathologically. Studies of large series of autopsy records have demonstrated the relative frequency of intranasal suppuration as a cause in cerebral pathology. Newton Pitt (15) in 1890 analyzed 9000 autopsies at Guy's Hospital and found 57 cases of brain abscess. In only one had nasal disease been responsible for a brain abscess. Gower (5) in 1893 in discussing the etiology of brain abscess stated that only a small proportion were secondary to nasal disease (6 cases of 240). Treitel (20) in 1895 reported 6000 autopsies at the Berlin Pathological Institute with 21 brain abscesses of which 3 were due to suppurative sinus disease.

When the frequency of nasal suppuration began to be appreciated following the introduction of routine examination of the sinuses at autopsy it was at first thought to be terminal and of no clinical significance. E. Fraenkel (3) in 1896 found sinus pathology in over 40 per cent of his autopsies. Lapelle (11) in 1899 in 32.5 per cent while Martin (12) in 1900 gives records of 31 autopsies in 15 of which there was an empyema of the sinuses. Wertheim (22) in 1900 made a routine examination of the nasal accessory sinuses in 360 necropsies. 195 were normal. 165 showed abnormalities of various degrees. In 26.3 per cent (95 cases) the changes were classified as empyemas.

With the increasing number of reports of fatalities due to sinus disease it soon came to rank in importance with otitis media and trauma in etiological significance. At the present time a number of such cases are recognized clinically every year in all large hospitals, some of which are proved at autopsy. Yerger (23) reports 16 fatal cases from the records of the Cook County Hospital during

the period 1911 to 1920. During this time 290,000 cases were treated of which 390,013 per cent were acute or chronic sinusitis with a mortality of 2.43 per cent.

Mrs M. F. age 35 entered the Cook County Hospital on January 13, 1923 on the service of Dr. Vernon Dauid with an admitting room diagnosis of probable brain tumor. She complained of pain in the right eye, pain in the head and inability to open her right eye. The duration of these symptoms was 6 months with an insidious onset. The history obtained from her husband was that the patient fell down 4 years ago striking the back of her head. She was well until a year ago (January 1922) when she became deaf in the right ear. At times there was a discharge from the nose which made the back of her head feel better. For the past 6 months there had been loss of vision in the right eye. Exophthalmos of the right eye was present for about 3 months. No vomiting. No frontal headache but there was pain in the right back of the head especially at night. For about 3 weeks she had been irrational at times. Her appetite was good but loss of weight amounting to about 40 pounds had occurred in the past 3 months.

Physical examination revealed a white adult female about 35 years old, poorly nourished and apparently acutely ill. Temperature 101.8 degrees F, pulse 104, respiration 40 on admission. The pupils were irregular, the right did not react. The left reacted to light and in accommodation. There was marked exophthalmos of the right eye and a complete ptosis. Ears externally were negative internally the left ear appeared normal, the right drum membrane was lustreless and quite scaly. In the upper posterior quadrant was a scab-like material resembling dried blood. Nose was negative to external examination. The upper teeth were all missing, many of the lower were out and there were several old decayed roots remaining. Marked pyorrhea alveolaris was present. The tongue was swollen, red, raw and beef-like in appearance. There was marked ulceration of the soft palate especially on the left side where the greater part of it had sloughed away. Ulceration was still active there being a purulent exudate along the edge. The pharynx was red, injected and had a dry glazed appearance. The thyroid gland was moderately enlarged and the posterior cervical glands were palpable.

The chest was normal in shape, expansion good and equal. The lungs showed normal resonance.



Fig. Photograph of the right eye of the patient.

voice sound and fremitus were normal. Heart borders were normal. The apex was in the fifth inter space at the nipple line. Tones were present over all areas clear and distinct. The liver, kidneys and spleen were not palpable. No tenderness, rigidity or tumor masses were present in abdomen. There was a slight superficial excoriation about 5 millimeters in diameter in the skin over the tip of the coccyx and there were a few hemorrhoidal tags about the anus.

On January 15, 1923, the patient was transferred to the neurological service of Dr. George B. Hassin for diagnosis and treatment. The important points in the neurologic examination were: A marked loss of strength. All the muscles were very flaccid, flabby and hypotonic. There was a marked intention tremor of both upper extremities, rather coarse but fairly rapid. Reflexes were all normal except a decreased right corneal reflex. The Kernig, Brudzinski, leg and neck signs were all positive. Babinski negative.

Examination of the cranial nerves showed total blindness of the right eye, paralysis of 3, 4, 6 and 7 on the right side, total deafness on the right side (paralysis of eighth nerve), watch tick was heard at about 6 inches from the ear on the left side. The tongue showed a marked tremor (tremor of the tongue).

Mental examination showed attention and cooperation poor, intelligence fair and memory doubtful.

Examination of the soft palate at this time showed extensive healed ulceration with bands of adhesion running to the posterior pharyngeal wall. The uvula was completely eroded away. Temperature 104 degrees F. Examination of the lung, January 15, 1923, showed no dullness but the crepitation was suppressed

breathing and a few showers of crepitant rales over the right base. Examination of the eyes by Dr. George F. Suker showed ophthalmoplegia externa and interna, right eye. Primary optic atrophy, right eye.

Spinal puncture revealed normal pressure, fluid slightly cloudy. The globulin and benzidin tests were positive. There were 80 cells per field of which 32 were lymphocytes, 48 polymorphonuclears and a few erythrocytes. The Wassermann reaction on the blood was positive on the spinal fluid, negative. The diagnosis made at this time was basilar meningitis (luetica) with the possibility of a retro-orbital gumma as the cause of the marked exophthalmos, lentic ulceration of the soft palate and luetic glossitis, hypostatic edema of the right lower lobe of the lung.

The patient was placed on antiluetic treatment and on January 17, 1923, the temperature went down to 100 at one reading but rose to 103 in the afternoon. She continued comatose and on the 18th died in coma with a temperature of 106.8 degrees F. Just before death with signs of a hypostatic pneumonia over the right lower lobe posteriorly.

The evening before the patient died I spoke to her husband and attempted to obtain additional information as to her past history. She had never had any miscarriages and had several apparently healthy children by her first husband. She had been married to her present husband 13 years but they had no children. Before he left he showed me a number of X-ray pictures of the sinuses that had been taken before the patient came to the hospital and that indicated a definite clouding of the right ethmoid and sphenoid cells. The patient however was too ill for a satisfactory rhinoscopic examination.

**Autopsy findings.** The autopsy was performed by Dr. H. Cideon Wells about 12 hours postmortem.

**External appearance.** The body is that of a slender built woman about 35 years old. There is a depressed scar 5 by 1 centimeter in the scalp at the left of the hair line. It is brownish yellow and not adherent to the skull. There is a cutaneous scar 2 centimeters in diameter midway between this scar and the orbital sinus. There is no noticeable exophthalmos of the right eye. The left pupil is 3.4 millimeters in diameter, the right 1 millimeter. There is no icterus. The superficial lymph glands are not palpable. There is a pigmented mole in the right arm. There is no edema. Rigor mortis is present. There are no signs of pregnancy on the abdomen. The mammary glands are atrophic. The external genitalia are normal. There is a small superficial ulcer over the coccyx.

**Abdominal cavity.** There is nearly 1 centimeter of subcutaneous fat. The peritoneum is smooth and dry. There are adhesions between the liver and diaphragm and between the liver and parietal peritoneum. There are fibrous adhesions over the tip of the appendix which is free. There are no other adhesions of the tubes and fallopian and gall bladder are free. The pelvic peritoneum shows many pigmented spots and fibrous tags over the bowels and bladder. The in-

te times empty. The femoral and inguinal ring are closed. The diaphragm is at the fourth interpace on the right and at the fifth rib on the left side.

**Pleural cavity.** The lung meet at the mid line. There are dense fibrous adhesions at both apices and over the diaphragm posteriorly extending upward to completely obliterate the cavity posteriorly on the right side.

**Pericardial cavity.** The pericardial cavity is normal in its structure and fluid content.

**Mouth and pharynx.** There are no upper teeth and the few lower teeth are in poor condition. The soft palate is adherent to the pharyngeal wall so that it forms a pocket involving the upper half of the pharynx and palate on the right side. The tongue is atrophic and flattened posteriorly. There are fibrous adhesions between the nasopharynx and soft palate. The right tonsil contains pus in its crypts. The epiglottis is normal. The larynx, trachea and esophagus are normal.

**Thyroid and thymus.** The thymus is missing. The thyroid is large (160 grams) and contains in each lobe several nodules of tissue of different color from the rest of the gland—the largest of these (2 centimeters in diameter) is partly calcified. Elsewhere the gland is exceptionally rich in colloid.

**Heart, aorta and vessel.** The heart weighs 300 grams and has stopped in systole. The coronary vessels are not unduly tortuous and are not sclerotic. The ductus arteriosus and foramen ovale are closed. The usual postmortem clots are present. The heart valves are normal except for slight warty thickening along the line of closure of the aortic and mitral valve and a slight fibrous degeneration on the aortic valve. The myocardium is normal except for a scar about 3 by 1.5 centimeters in the anterior septum between the ventricles; this has a dense center and fades out into the adjacent myocardium. The aorta throughout is grossly normal except for a few yellow fatty streaks.

**Lungs.** The lungs collapse incompletely. Each weighs 520 grams. There are scars in both apices where fibrous nodules are palpable. There is some fibrin on the posterior left pulmonary pleura. The posterior portions of both lungs are boggy, mottled and nodular. Cut surfaces are mottled dark red in color. In the posterior portions of both lungs there are numerous small gray granular areas of consolidation in the dependent parts. The anterior portion of both lungs are somewhat inelastic but not edematous. The main vessels are free from thrombi. The bronchi are hyperæmic but not purulent.

**Peribronchial gland.** These are for the most part normal. One tracheal gland shows an extensive calcareous lesion. One gland at the hilum of the right lung contains a small calcified tubercle.

**Liver.** The liver weighs 340 grams. The cut surface is mottled. No fibrosis and no gummatous lesions are evident. The gall bladder is normal.

**Spleen.** The spleen weighs 140 grams and shows no gross abnormalities.



Fig. 1. Photomicrograph of a section of the wall of the right pharynx showing necrosis and suppuration of the bone ( $\times 6$ ).

**Pancreas** is normal.

**Gastrointestinal tract.** The stomach and intestines are normal. The reaction is hyperæmic but otherwise normal.

**Adrenal.** The adrenals are somewhat large but do not contain much lipoid.

**Kidneys.** The kidneys are alike and weigh together 320 grams. The cut surface is pink and bulges somewhat. Cortical markings are somewhat obscured. The capsule is extremely adherent. The cortex is slightly thinned. The pelvis is normal. The urinary bladder is normal.

**Generative organs.** The vagina is smooth. The cervix of the uterus is wide and gaping and exudes a bloody fluid. The corpus uteri contains a blood clot. The left ovary contains a large yellow corpus luteum. There is a cyst attached to the right ovary and there is a calcified thrombus in a vein of the left broad ligament.

**Lymph glands in general.** The retroperitoneal, mediastinal, mesenteric and cervical lymph glands are not abnormal in size or appearance.

**Brain and meninges.** The dura is tense and is not as transparent as normal. It is not adherent to the calvarium or the pia. The brain is pushed up and the convolutions flattened. The right optic nerve is embedded in a purulent sheath which gives off a putrid odor. The contents of the orbit behind the eye are entirely necrotic and infiltrated with thick pus so that individual structures are unrecognizable. The dura is adherent in the vicinity and the necrosis extends over the sella turcica. The floor of the skull anteriorly is red and rough as far as the cribriform plate and an isolated piece of the orbital surface of the ethmoid bone can be picked out with the forceps.



Fig. 3. Cross section of the right optic nerve showing destruction of the fibers and polymorphonuclear leukocytic infiltration particularly marked at the periphery (X60).

The orbital portions of the greater and lesser sphenoidal wings are necrotic. There is a perforation of the nasal septum. The right posterior ethmoid and sphenoid sinuses are full of solid pus. The hypophysis is unrecognizable. The right gasserian ganglion is normal. The right cavernous and circular sinuses contain a purulent thrombus and the tissues about them are necrotic. The other sinuses are normal. There is a focus of necrosis behind the left optic nerve.

**Skeleton.** The bones of the trunk are normal. The frontal bone shows no changes beneath the scar on the forehead.

**Anatomical diagnosis.** Suppuration in the right posterior ethmoidal and sphenoidal sinuses extending along the right optic nerve and involving the sella turcica; destruction of the hypophysis; suppurative thrombus in the right cavernous and circular sinuses. Necrosis of the orbital portions of the ethmoid and sphenoid bones. Perforation of the nasal septum. Syphilitic cicatrix of the right pharyngeal wall and atrophy of the dorsum of the tongue. Healed syphilitic gummatous of the myocardium. Scar in the scalp. Bilateral hypostatic bronchopneumonia. Bilateral adhesive fibrous pleuritis. Caseocalcareous tuberculosis of the peribronchial lymph glands. Healed tuberculous scars in both pulmonary apices. Slight chronic interstitial nephritis.

Parenchymatous changes in the kidneys. Fatty changes in the liver (slight). Menstruating uterus and corpus luteum in the left ovary. Healed fibrous peritonitis. Phlebolith in the left broad ligament. Adenomatous and diffuse colonic hyperplasia of the thyroid gland (goiter). Slight terminal acute vegetative aortic and mitral endocarditis.

Smears from the pus and sections of the sinus wall were examined by Dr. I. Pilot in connection with his studies of the bacteriology of putrefactive infections and he found numerous streptococci bacilli and spirochaetae such as he has described in gangrene of the lung.

Histological sections of the sinus wall showed the mucosa transformed into a pyogenic membrane but the bone itself was intact. There was no evidence of syphilitic involvement of the bone or mucoperiosteum. In sections taken from the suppurative area there were seen only necrosis and leucocytic infiltration with no evidence of tuberculosis or syphilis. No traces of the hypophysis remained. In cross sections of the right optic nerve at the chiasm no normal tissue could be found. The entire nerve was replaced by a necrotic mass of tissue densely infiltrated with polymorphonuclear leucocytes indicating an acute process. The brain tissue in the neighborhood of the optic chiasm was the seat of a diffuse encephalitis with marked polymorphonuclear infiltration of the perivascular lymph spaces.

#### CEREBRAL COMPLICATIONS OF SINUS

The cerebral complications associated with accessory nasal sinus disease are the most serious and usually fatal. They are due to extension of an inflammatory process occasionally a malignant tumor to the brain or its meninges producing pachymeningitis, leptomeningitis, involvement of the brain substance with the formation of an abscess, extradural or intradural abscess and thrombophlebitis of the cerebral sinuses or a combination of these.

Exact figures of the relative frequency of intracranial complications are difficult to obtain. The early reports consist largely of single case reports. Yerger (23) collected 16 out of a total of 390 cases of acute and chronic sinusitis, 4 per cent from the records of the Cook County Hospital during the period 1911 to 1920 inclusive.

#### ETIOLOGY OF SINUS INFECTIONS

Kuhnt (10) distinguishes between primary infections depending upon inflammations of the sinus mucosa and secondary lesions due to disease of the bone such as trauma, foreign bodies, tumors. Since the sinus mucosa is a continuation of the nasal mucosa, acute and chronic rhinitis frequently lead to infection of the sinuses. If drainage is adequate the sinusitis subsides with the rhinitis. Of infectious diseases that frequently lead to sinusitis the



Fig 4 Longitudinal section of the left optic nerve. Polymorphous nuclear coccidial infiltration of the sheath ( $\times 100$ )



Fig 5 Section of the bulbous part of the superior sagittal sinus. Leukocytic infiltration ( $\times 20$ )

following may be mentioned measles scarlet fever diphtheria erysipelas pneumonia typhoid fever influenza glanders actinomycosis lues and tuberculosis. According to the type of inflammation three varieties are recognized sinusitis catarrhalis hemorrhagica and pyorrhoeica. One variety very commonly goes over into another especially catarrhal into suppurative. Clinically sinus infections may be acute or chronic with exacerbations and remissions over a period of months and year.

The mortality from sinus infections is due entirely to cerebral complications. Birch-Hirschfeld (2) reports 409 cases of nasal accessory sinus disease with 52 deaths a mortality of 12.7 per cent. Infections of the sphenoidal sinus were associated with the highest mortality comprising 28 per cent of the total the ethmoidal sinus 6 per cent. The following causes of death were found meningitis 34 frontal lobe abscess 15 sinus thrombosis 6 sepsis 2. In Verger's (23) series of cases the ethmoidal sinus was involved in 12 per cent the sphenoidal sinus in 2 per cent. However with respect to the occurrence of intracranial complications the sphenoidal sinus ranked first with 55 per cent while the ethmoidal sinus was second with 19 per cent.

#### THE ANATOMY OF THE POSTERIOR SINUS GROUP (ONODI 13)

In order to appreciate clearly the frequency of intracranial complications of posterior sinus disease a knowledge of their normal and pathological anatomy is necessary.

The ethmoidal labyrinth is impacted between the frontal and sphenoidal sinuses in the sagittal position. Externally it borders on the orbital cavity internally upon the middle and superior turbinal and the middle and superior meatus. The labyrinth is built up of ground lamellae which separate its various divisions from each other. The lamellae studied by Seydel extended to the processus uncinatus the bulla ethmoidalis the middle and superior turbinates. The passages between the lamellae are termed interturbinal passages. They are separated into ethmoidal cells by transverse septa and ledges. These cells vary considerably in position and extent.

The ethmoidal cells are divided for general description into anterior and posterior. The anterior cells open into the middle the posterior into the superior meatus of the nose although an anterior cell may lie posteriorly and a posterior cell anteriorly. The anterior cells may communicate with the recessus frontalis the ductus nasofrontalis hiatus semi-

lunaris and recessus bullaris. The anterior portion of the middle meatus may be the seat of communication between the frontal maxillary and anterior ethmoidal cell. The bulla frontalis, the ethmoidal cell directly behind the frontal sinus, its wall forms part of the wall of the frontal sinus, the fronto-orbital cell, located in the horizontal plate of the frontal bone. The ethmoidal cells of the superior meatus are in general termed the posterior ethmoidal cells. The last cell may extend into the sphenoid bone and on this account Zuckerkandl (24) has named it the phenoidal ethmoid cell. This cell may lie above the phenoidal sinus bordering on the sella turcica and optic foramen. Onodi has termed the posterior ethmoidal cell which extends to the horizontal plate of the frontal bone the posterior fronto-orbital cells.

The bulla frontalis, the fronto-orbital cell and the turbinal cell of the frontal group are inconstant in the posterior group, the sphenoidal ethmoid cell, the fronto-orbital cell and the turbinal cell are equally inconstant. In the middle meatus the bulla ethmoidalis produces a constant structure by its formation of the *hirsutus semilunaris*. The bulla ethmoidalis may vary greatly in size. Posteriorly it may approach the sphenoidal sinus above the anterior cranial fossa. It empties into the middle meatus but may open into the superior.

The posterior ethmoidal cells belong to the group emptying into the superior meatus. Individual posterior cells may empty into a neighboring cell. Their extent is very variable. They may extend far forward posteriorly or into the horizontal plate of the frontal bone.

Of special practical importance in the spread of pathological processes is the occurrence of bony dehiscences in the ethmoidal sinuses. In a study of 4000 skulls Onodi found in 18 cases congenital dehiscences in the *lamina papyracea* of the ethmoid. Because of such dehiscences the ethmoidal cell may communicate with the orbital cavity, the frontal sinus may communicate with both the ethmoidal cavities and the orbit.

Developmental anomalies in the relation between the posterior ethmoidal and sphenoidal cell and the sulcus opticus and canalis

opticus are of great importance in connection with the spread of inflammation from these sinuses to the optic nerve. The following anatomical variations have been described by Onodi. The posterior ethmoidal cell forms the medial and inferior wall of the canalis opticus. The right inferior ethmoidal cell is the medial wall of the right canalis opticus, the left ethmoidal cell the medial and inferior wall of the left canalis opticus and the wall of the left one third of the sulcus opticus.

The sphenoidal sinus is variable in size and lies in the center of the body of the sphenoid bone. It possesses an anterior posterior superior inferior and an inner lateral wall. Usually the superior wall is in relation with the roots of the lesser wings of the sphenoid, the foramen opticum, the planum sphenoidale and the sella turcica. Within the latter lie the hypophysis covered by the chiasma nervorum opticum. That portion of the planum sphenoidale which lies between the chiasm and both optic nerves is termed trigonum precellulare and is usually formed by the superior wall of the sphenoidal sinus, however it may be partially or entirely formed by one of the posterior ethmoidal cells.

The inferior wall, the floor of the sphenoidal cell, varies in thickness. When the sinus is extraordinarily large it may be paper thin usually except for the posterior wall, it is the strongest. It forms part of the posterior superior roof of the nasal cavity and part of the roof of the nasopharynx. Occasionally there is a fusion of the phenoidal sinus with the nasopharynx by means of a persistent fetal ductus cranio-pharyngeus.

The inner wall, the septum intersphenoidale, divides the cells on each side into symmetrical spaces lying in the midline in sagittal section. The septum may vary in form, shape and location. One cell may even be entirely absent.

The lateral wall helps to form a portion of the middle cranial fossa and contains the canalis caroticus. It borders directly upon the sinus cavernosus and forms part of its bony wall which may be as thin as writing paper. Numerous minute openings are visible in the bone giving exit to veins which communicate with the cavernous sinus.

The posterior wall is usually strong. It is united by bony union with the os occipitale basilar and may border on the upper portion of the clivus. When the sinus is unusually large its thickness may be reduced.

The anterior wall contains the natural opening of the sinus, the ostium sphenoidale. Usually this is located in the sulcus extending between the anterior wall and the posterior limit of the ethmoid, the recessus sphenoidalis. However it may lie medially near the anterior wall or high up under the roof of the nasal cavity. The sphenoidal duct may vary in size from 0.5 to 5 millimeters. It may be a round, oval, half moon shaped opening or a mere slit. According to Zuckerkandl the anterior wall may be divided into two portions, a smaller medial portion, pars nasalis, and a larger lateral portion, pars ethmoidalis. The anterior wall may form part of the roof of the antrum or the posterior wall of the frontal sinus. When the sphenoidal sinus is very large the inferior lateral portion of the anterior wall may form part of the fossa pterigopalatina.

The sphenoidal cell may extend to the bulla ethmoidalis and even form part of a common wall with an anterior ethmoidal cell. It may extend into the greater or lesser wings of the sphenoid and posteriorly it may rest against the clivus. Onodi gives the following dimensions of the sphenoidal sinus. Length between 9 and 60 millimeters, width about the same height between 9 and 42 millimeters. The anterior nasal wall is from 5 to 20 millimeters high and 8 to 28 millimeters wide.

The sphenoidal sinuses may be markedly asymmetric. The left sinus may extend over the right to the right canal, opticus. One sinus may be entirely absent. The sphenoidal sinus may border closely upon the anterior middle or posterior cranial fossa and lie in close relationship to the nerves, vessel, and portions of the brain in the regions. Zuckerkandl has described dehiscences in the lateral wall by which the sinus communicated with the middle cranial fossa. Its relation to the canal, opticus and sulcus opticus is very important. One or both sinuses may form part of the wall of the canal or sulcus opticus or both. The thickness of this portion of the bony

wall of the sinuses is very important in connection with the spread of pathological processes to the optic nerves. Onodi's studies have shown that the wall between the most posterior ethmoidal cell and the canal and sulcus opticus is usually extremely thin. The wall between these structures and the sphenoidal sinus is more commonly a stronger one. It may vary from paper thin (Berger and Tyrmann<sup>1</sup>) to 7 to 12 millimeters.

In addition to the chiasm and optic nerves the sphenoidal sinus is in direct close relationship in the center of its superior wall with the hypophysis cerebri with the circulus venosus and near its lateral wall with the carotis interna and sinus cavernosus. By means of excessive enlargements already mentioned it may come in contact with the following structures: gasserian ganglion, first, second and third divisions of the trigeminus with the divisions of the oculomotorius passing through the fissura orbitalis superior, trochlearis and abducens.

#### PATHOGENESIS OF INTRACRANIAL COMPLICATIONS

The pathogenesis of the intracranial complications may be subdivided as follows: (1) bacterial infection, (2) predisposing factors, (3) the nature of the cerebral involvement, (4) route of infection.

1. *Bacterial infection.* In mild low grade infections of which mucocoele is an example, dilatation of the sinus may occur with atrophy of its bony walls. The mucous membrane may disappear but it does not suppurate. Suppurative infections produce destruction of the mucous membrane and bony structures as well as complications in the orbit and brain.

Most of the cases involving the ethmoidal and sphenoidal sinuses are chronic, less often acute, and in some the duration cannot be determined. In a few cases syphilis is given as the etiologic factor.

Bacteria have been demonstrated in normal sinuses. Fraenkel (3) found pneumococci most commonly. Streptococci, staphylococci and pneumococci are the most common causes of infection. Less commonly bacillus diphtheriae, bacillus influenzae, bacillus Friedlander and the meningococcus, Bacillus pyocyaneus



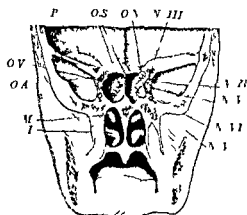


Fig 6 Frozen section of a tooth. The tooth was cut immediately in front of the sinus. The section was taken from behind the orbital roof of frontal sinus. OS, ostium sphenoidal sinus; III, right and left sphenoidal sinuses; I, middle and middle sphenoidal sinus; OA, optic nerve with phthalmic artery; OV, ophthalmic vein; OA, phthalmic artery. (After C. R. Holmes, *Archives of Ophthalmology*, 1906, 25, p. 467. Prepared from a specimen from the tooth by after death.)

*bacillus coli* and anaerobic organisms (*bacillus fluorescens*, *bacillus liquefaciens putridus*, *diplobacillus foetidus crassus*, *bacillus pyogenes foetidus*) have been found. It is not certain that all these organisms are of pathogenic significance. On the basis of bacteriological studies Stanculeanu and Baup (18) distinguish two types of empyema: (1) With fetid pus involving the antrum following affections of the teeth. These are produced mainly by anaerobic bacteria (*bacillus ramosus*, *bacillus serpens*, *bacillus perforans*, *bacillus theloide*, *bacillus fragilis* and *staphylococcus parvulus*). (2) Those with mucopurulent nonfetid content which are of nasal origin are usually produced by aerobic organisms (*pneumococci*, *pneumococci* and *streptococci*, *pneumobacilli*, *pneumococci* and aerobic *streptococci* alone or *staphylococci* alone).

2. Among the important predisposing factors may be mentioned congenital defects in the bony walls of the sinuses which have already been considered in connection with the discussion on anatomy. In the case of the ethmoidal sinus defects in the lamina cribrosa may lead to communications between the ethmoidal labyrinth, fissure olfactoria and the cranial cavity. Defects in the superior lateral

recesses of the sphenoidal sinus also occur. Energetic and rash operative manipulations may lead to infection of the neighboring cranial cavity, the meninges and brain substance itself.

Stasis of secretion and pus due to an absolute or relative interference with excretion is an important predisposing factor. Acute inflammations cause a hyperemia and swelling of the sinus mucosa and this frequently leads to an occlusion of the ostium, especially if it is small. In our case the stenosis of the nasopharynx interfered with proper excretion and undoubtedly contributed a share in the production of the intracranial complications.

3. *The nature of cerebral involvement.* In pachymeningitis externa circumscripta in the neighborhood of the bony involvement and its covering dura, the latter loses its gloss, becomes thickened and discolored. Occasionally pseudomembranous exudates are found containing masses of granulations. There are extradural abscesses between the dura and bone. There may be an actual bony defect or only a reddened surface or an intradural abscess of which pachymeningitis interna is a forerunner. The dura and pia become adherent later; an intrameningeal abscess forms but usually a brain abscess or diffuse meningitis results as the process practically never stops with the formation of an extradural abscess. Brain abscess is produced by hematogenous spread frequently by means of septic thrombophlebitis, extension through the lymphatics or by direct continuity from an intradural abscess.

Localized meningitis occurs with intradural abscess and brain abscess. When this breaks through a diffuse leptomeningitis results. Thrombophlebitis may give rise to meningitis. There may be direct extension from the sinus by means of regional metastases or following operative injury of the dura with infection of the pia.

Thrombophlebitis of the dural sinuses involves most commonly the sinus cavernosus, less often the sinus longitudinalis superior.

Meningitis serosa has been occasionally described in which there is an increased amount of fluid on the surface of the brain. No organisms are found and the condition is due

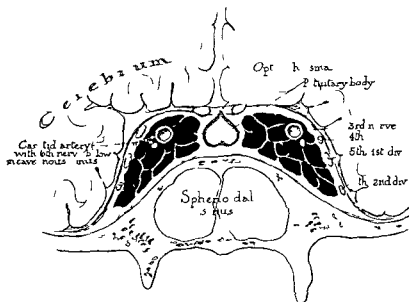


Fig 7 (Semi-diagrammatic) Coronal section through sphenoidal sinus to illustrate immediate relationship with cavernous sinuses and optic chiasm (Thomson)

to toxic irritation analogous to chemical peritonitis

**4 Route of infection** When infection takes place through continuity there is definite macroscopic evidence of pathology in the tissues separating the sinus from the cranial cavity. In other cases complications have occurred but there was no macroscopic evidence of pathology.

The following methods of extension may be considered: extension by direct continuity along the tissues with suppurative softening of the mucous membrane, subperiosteal abscess and necrosis of bone. The necrotic bone containing pyogenic bacteria produces on the cerebral side an intradural abscess following which meningitis, cerebral abscess or sinus thrombosis may develop.

When the tissue separating the sinuses from the cranial cavity are rapidly destroyed, diffuse meningitis or sinus thrombosis occurs without the intervention of extradural and intradural abscess. The former is seen following the rapid exfoliation of the lamina cribrosa of the ethmoid; the latter in the breaking down of the roof of the sphenoid and spread of infection direct to the large dural sinuses.

In regional metastases only a circumscribed reddening of the underlying bone points to the source of infection of an extradural or intradural abscess. Of importance in this connection is the anastomosis between the veins of the sinuses and the ophthalmic vein and dural capillaries.

The ethmoidal sinus is usually involved with several other sinuses and is the last bone to be affected. Thus it may be associated with suppuration in the sphenoidal sinus, the maxillary or frontal sinus. Of 28 cases of intracranial complications of ethmoid sinus disease analyzed by Hajek (8) 12 were acute. The most common anatomical change was caries of the lamina cribrosa; in three the caries was luetic. Where caries did not exist the process was most intense over the ethmoid plate.

The most common complications of sphenoidal sinus infection are meningitis and thrombophlebitis of the sinus cavernosus. Of over 60 recorded cerebral complications studied by Hajek, not less than 26 were meningitis, either alone or in combination with extradural and intradural abscesses in the region of the sella turcica. Next most frequent is thrombosis of

the cavernous sinus in 18 cases this was combined with meningitis in 5 cases it occurred alone. Other complications described are thrombosis of the sinus longitudinalis complicating a meningitis and cerebral abscess. Usually the intracranial complications are of a combined nature.

Infection spreads from the sphenoidal sinus in several ways (1) By breaking through the diploe. In St. Clair Thomson's (19) study of 42 cases of intracranial complications due to septic infection from the sphenoidal sinus there were 11 in which no macroscopic changes were visible in the bone. (2) By thrombophlebitis of the veins. Sieur and Jacob (17) have shown that the veins of the mucous membrane of the sphenoidal sinuses anastomose with the sinus cavernosus. This accounts for the frequency of thrombosis of the latter. (3) By caries of the bony walls of the sinuses which form part of the base of the skull and are very thin in places. The thickness of the bony wall toward the side of the sella turcica and the upper lateral wall toward the sinus cavernosus is seldom more than 1 to 2 millimeters. In addition there are the bony dehiscences in the lateral upper walls as pointed out by Zuckerlandl in which the mucous membrane of the sphenoidal sinus may lie directly against the dura mater. In a number of cases the process broke through the fossa pterygoidea and infection spread by way of the plexus pterygoideus. (4) By lymphogenous spread which is possible but has never been demonstrated. It is probable that when thrombophlebitis occurs the lymphatics are also involved in the process but this is of secondary importance. In a small number of cases it is impossible to say how infection reached the intracranial cavity.

#### OPHTHALMIC COMPLICATIONS

The close anatomical relationships between the posterior group of cells and the optic nerve and orbit explains the frequency of extension of inflammatory processes from one to the other. Birch Hirschfeld (2) reports that almost 60 per cent of cases of orbital inflammation are due to sinus infections. The process may reach the orbit by direct continuity producing periostitis orbitalis cellulitis or

orbital abscess. In empyema of the posterior sinuses thrombophlebitis of the veins may lead to involvement of the orbit by means of their rich anastomosis. The anterior and lateral walls of the sphenoidal sinuses contain veins which anastomose with the orbit and the ethmoidal venous plexus anastomoses with the dorsal capillaries.

Injury to the optic nerve may be due to compression of its avascular portion by pressure of the inflammatory exudate upon the central artery of the retina or to direct extension of the suppurative process to the nerve as it passes through the canalis opticus as in our case. In a careful search of the literature only four cases were found in which there was complete destruction of one or both optic nerves by a suppurative process. The first case was reported by Raymond (16) in 1885 in which the optic nerves, the chiasm and optic tract, were injected and softened due to infection of the left sphenoidal sinus. The second is a case seen by Professor Elschnig in 189 and reported by Gradle (6). A carcinoma of the right antrum secondarily infected had broken through into the orbit and had formed an abscess of the optic nerve. The third case is that of Higgins (9) (1897) in which there was a diffuse meningitis with complete destruction of the optic nerves. The last case was reported by Oeller (14) in 1901 and the changes described were a softening of the optic nerve with interstitial inflammation of the neighboring pia and septa. The acute necrosis involved both nerves at the center of their course through the orbit behind the entrance of the vessels. Clinically the results are first a narrowing of the field of vision and later amblyopia. In spite of total amaurosis of weeks duration the ophthalmoscopic picture may remain practically normal and only later does the papilla show atrophic discoloration while the retina and papillary vessels are normal. With removal of mechanical pressure even in high grade amblyopia there may be a return to normal.

The typical ophthalmic condition in posterior sinus disease is retrobulbar neuritis resulting from the direct extension of the process to the optic nerve. The sphenoid and posterior ethmoid sinuses because of their

close anatomical relation with the canalis opticus most frequently produce visual disturbance. The pathogenesis of retrobulbar neuritis is a toxic involvement of the optic sheath through the passage of material along the perivascular lymphatics in the foramina.

The clinical symptoms are quite variable. Vision may be normal while visual acuity is reduced. The fundus findings may be those of retrobulbar neuritis with temporal pallor and involvement of the maculopapular bundle. In other cases the picture is that of optic neuritis. Occasionally the ophthalmoscopic appearance is that of thrombosis of the central vessels. In acute cases vision may be rapidly lost. In chronic cases the process is slower and may extend over a period of years with intervals in which it is apparently stationary. Changes in the fields of vision of various sorts have been described including concentric temporal and nasal narrowing but the most common is a peripheral narrowing. The visual fields however may be entirely normal. Various types of scotomata have been described central pericentral ring like wedge shaped paracentral and hemianopic. A rather characteristic change accompanying posterior sinus infections according to Van der Hoeve and de Kleyn (21) is an increase in size of the blind spot and at first for color. It is supposed to occur very early when visual acuity and fundus are still normal and for a long time may be the only symptom of posterior sinus disease.

#### THE RELATION OF SYPHILIS TO SINUS DISEASE

In 1886 Berger and Tyrmann (1) stated that the consensus of opinion among rhinologists and ophthalmologists at that time was that canes and necrosis of the sphenoid bone was most commonly due to syphilis. Ten years later Gruenwald (7) saw no reason why a patient with syphilis could not have nasal accessory sinus suppuration. The relation of syphilis to the latter must be proved by histological examination or the therapeutic test when only specific treatment is given. Gerber (4) in 1910 believed that this may be a factor in the production of empyema of the nasal accessory sinuses in the sense that infection is permitted to enter through an ulceration in a

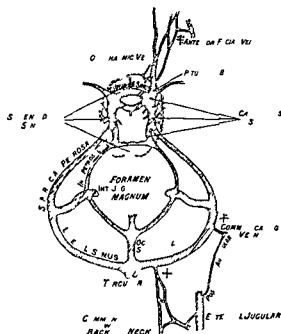


Fig 8 D gram t sh w mmunic tion f v ins of ca ern us sin s with no sinuses of the c nu m sh i g also inter l t n f tra s erse and c ern o s in ses with extern l vein The asterisks ( ) ma k the anastomo s of the atracram l enous ystem with th veins of the surfa (Th mson mod fied f om Leube)

turbinate or a broken down gumma in the septum. The bony walls of the sinuses may be the seat of a syphilitic osteitis or periostitis but this is uncommon. Usually the syphilitic process merely acts as a predisposing factor as in our case by interfering with proper drainage.

## SUMMARY

A case of suppurative posterior ethmoiditis and sphenoiditis with unusual cerebral complications has been described including a discussion of the normal anatomy of the sinuses and the pathogenesis of cerebral and ophthalmic complications. Such a complete destruction of the optic nerve due to infection alone has never been reported as far as I have been able to learn from a careful search of the literature.

Clinically the true intracranial pathology was overlooked because attention was focused upon the obvious manifestations of syphilis. The unilateral exophthalmos and primary optic atrophy should have suggested cover

nous sinus thrombosis but the patient entered the hospital in the terminal stages when the acute manifestations of nasal infection were forgotten. That they were present and received consideration is evidenced by the fact that the husband of the patient possessed X-ray pictures showing clouding of the ethmoidal sinuses.

Another factor that did not receive sufficient consideration clinically was the examination of the spinal fluid. In syphilitic meningitis the spinal fluid Wassermann is usually positive and the increased cell count is due entirely to lymphocytes. The negative spinal fluid Wassermann and the fact that the majority of the cells were polymorphonuclear leucocytes should have ruled out syphilitic meningitis.

There was no evidence either grossly or microscopically of syphilitic involvement of the bony walls of the sinuses. The only influence of syphilis upon the pathological condition in this case was the interference with proper drainage produced by syphilitic scars in the nasopharynx.

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## A DEVELOPMENTAL ANOMALY OF THE PATELLA FREQUENTLY DIAGNOSED AS FRACTURE

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WHILE nothing new in the light of fact is offered in this contribution it is presented with the idea of bringing to the attention of surgeons particularly those interested in industrial accident work the importance of a correct diagnosis of fractures of the patella.

The patella is a true sesamoid bone and like sesamoid bones in other parts of the body it is subject to anomalies in its development. It is generally agreed that lime salts are first laid down in the patella from the fifth to the sixth year. The patella usually develops from one center of ossification although various investigators have stated that it occasionally develops from two centers. Even when arising from two centers of ossification the fully developed patella is usually a single bone. Rarely it is found to consist of two or more bones.

In 1902 Joachimstal was the first to describe the particular anomaly of the patella wherein the patella consists of two or more separate bones (Fig. 4). Other authors particularly Kohler in the third edition of his book *Grenzen des normalen und Anfänge des pathologischen im Röntgenbilde* describes this anomaly. One or two others both English and French writers have mentioned a similar condition.

Mouchet reports one case calling attention to the condition here described and also mentions observation done on the cadaver.

Moreau reports three cases of a similar condition.

Reinhold publishes a report of four cases.

Todd and McCally present a long and very exhaustive article on anomalies of the patella resulting from work done on the cadaver and mention this condition in conjunction with defects in the patella margin.

In our own experience during the last 5 years six of these cases have come to our attention. Four out of the six had been diagnosed erroneously as fractures. And it is for this reason that we feel that it might be helpful to call the attention of the profession to this anomaly.

Both in the literature and in our own experience all cases of this anomaly present the same X-ray appearance (Fig. 1). The outer and upper quadrant of the patella the portion which is always involved may consist of one or two separate fragments of bone. The general contour of the patella is not distorted. The separate fragment of bone has the same structure as the main portion of the patella. It is entirely surrounded by cortical bone the mid portion resembling normal cancellous bone. The outer and upper surface is curved

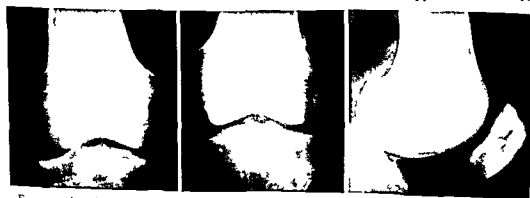


Fig. 1. C. Roentgenogram of the patella illustrating developmental anomalies.



Fig. 3. Anteroposterior and lateral knee in Case 3.

the inner surface which is contiguous with the main portion of the patella is flat or in the anteroposterior view appears as a straight line. There is a definite space between the adjacent surface of this fragment which is about one sixteenth of an inch in width and uniform throughout its entire length. This separated fragment may occasionally itself be divided into two parts, the periphery of both portions consisting of cortical bone, the adjacent margins being straight with a smooth outline. In our experience this developmental anomaly is found in a great majority of cases to be bilateral. In our series of six cases five were bilateral. This is the experience of both Kohler and Joachimistal.

The counterpart of this patella anomaly is found in one of the sesamoid bones beneath the head of the first metatarsal. It is very commonly observed that this bone which normally is a single bone may develop in two parts. The structure and relation of the bipartite sesamoids of the great toe are identical with the structure and relations of this congenitally divided patella (Fig. 5).

Fractures of the sesamoid bone may occur. The appearance seen in the X-ray differs from the figure here shown in that the edges of the fragments are irregular and serrated, having the characteristic appearance of fragments in any fresh fracture.

Fractures of the patella may result from direct violence. When due to direct trauma fractures may be of a stellate character with out much displacement, the capsule remaining intact. We also find simple linear frac-



Fig. 4. Oblique fracture of patella reported by Joachimistal.

tures running vertically or in any of the other diameters as the result of direct violence. One rarely find an oblique fracture of the edge of the patella in the location of this congenital anomaly. Many fractures of the patella are due to indirect violence in which unusual stress is put on the quadriceps muscle and the patella tendon. The patella being at the fulcrum against the resisting surface of the femur is fractured instead of the tendon of the quadriceps becoming ruptured. In these fractures due to indirect violence the line of fracture is usually of the simple linear type running transversely across the patella. Frequently there is rupture of the capsule with varying degrees of separation of the fragments.

Fractures of the patella are of course accompanied by a definite history of trauma and with the usual clinical manifestation of bone injury.



Fig. 5. Sesamoid bone bipartite first metatarsal showing congenital bipartite which is identical to the patella.

A differential diagnosis between this developmental anomaly and fracture may possibly be made first by a difference in the outline of the fragments.

As we have stated previously the outline of a congenital fragment is smooth and consists of cortical bone whereas a fracture shows a more or less serrated edge and involves cancellous bone. Second the location of a linear shadow helps to determine whether a fracture is present or whether it is only a congenital variation. It is rare to find fractures in the outer and upper quadrant of the patella which is always the location of the congenital anomalies. Third the congenital anomalies are not accompanied with the usual clinical story found with real fracture. Fourth the most important congenital anomalies are nearly always bilateral and a radiogram made of the knee frequently is all that is necessary to make a positive differential diagnosis.

The correct diagnosis of abnormal conditions of the patella on general principles is naturally desirable but it is of particular importance from the standpoint of the industrial accident cases for economic reasons if for no other.

Three cases coming to our attention during the past year were examined by us for the Industrial Accident Board. This Board during the same period of time examined sixty three cases of fractured patella. Included in these sixty three cases were our three cases of congenital anomalies incorrectly diagnosed as fracture.

In this brief series we find an error of 3.17 per cent. Two of these cases have been under treatment for many weeks as fractured patella. The erroneous diagnosis in these cases represents a needless economic loss to the patient insurance company and indirectly to the community.

The following three cases are typical illustrations of this condition.

**CASE 1** Male age 36 injured October 29 1924. The injury was comparatively trivial. While scooping up some gravel his foot slipped and he struck the handle of the shovel that he was using. The patient continued work during the day complaining of slight discomfort in the patellar region. The

next day he was X-rayed and an erroneous diagnosis of fracture made from the X-ray film. The patient has been under the usual treatment for fractured patella ever since. The doctor states that the patient should be able to return to work in a few days from now. February 24 1925. Examination which was made by us of this patient on January 7 1925 (Fig. 1) shows the typical congenital developmental anomaly which is bilateral. There is no evidence of fracture. The patient's prolonged disability of course is due mainly to fixation plus a certain amount of mental unwillingness to return to work.

**CASE 2** Male age 21. On December 24 1924 he stepped back to avoid a loaded truck his foot slipped through the edge of an open elevator wall and he twisted and struck his left knee. Patient was seen 3 hours after the accident. Examination showed a badly swollen and discolored knee with the joint full of fluid. A ham splint was applied. Forty-eight hours later an X-ray was taken. The condition in upper quadrant suggested a second film which was taken of both knees (Fig. 3). A plaster cast was applied and removed at the end of 10 days. The joint then was free from fluid. Patient had a normal convalescence. He returned to work January 24 1925 4 weeks following injury.

**CASE 3** This is a case of an industrial worker who sustained an injury to the knee joint while at work. As in the two previous cases patient came under the compensation law and was passed upon as being compensable. A diagnosis of fracture was made. The X-ray showed a picture comparable to that of Cases 1 and 2. Unfortunately it has been impossible to obtain a print of this picture.

A survey of the cases of fractured patella which passed before the Industrial Accident Board for consideration shows a period of disability of about 5 months.

The ever increasing number of industrial cases entailing an economic loss to industry and financial depletion to the patient in addition to compensation paid by insurance companies demand the highest standard of precision of diagnosis.

## CONCLUSIONS

1. Congenital anomalies of the patella are more common than has generally been supposed.

2. In our series of sixty three cases of fractured patella during one year over 3 per cent were congenital anomalies erroneously diagnosed as fractures.

3. The differential diagnosis between a congenital anomaly and fracture can easily be



made from an X-ray film (a) These deformities are usually bilateral (b) The adjacent surfaces of the bones are smooth and consist of cortical bone (c) The congenital anomalies are located in the outer and upper quadrant which is a rare location for fracture (d) The absence of a typical clinical history and the symptoms usually associated with fracture should make the examiner suspicious that he is dealing with a congenital anomaly.

4. The recognition of the possibility of this congenital anomaly is important for economic reasons if for no other

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# INGUINAL HERNIA AND OPERATIVE PROCEDURE<sup>1</sup>

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TO assist me in making what I have to say clear I will narrate the following little allegory

Once upon a time in an era that need not be specified 2 sea captains were discussing what was at that time a vexed question the shape of the earth. Said the first mariner (whom we shall call A) Flat of course why not? An old friend who knew a great deal about such things told me so many years ago I myself have been for 30 years trading between Europe and the East and I always take care to come back by the way I went lest I should go over the edge of the World

Then Mariner B— Nay you are surely mistaken. For 30 years I too have been trading between Europe and the East but instead of returning by the way I went I have always continued on my easterly course which brings me back to Europe again. The earth must therefore be a spheroid and not a flat surface. Incidentally my experience has brought to me knowledge of countries and peoples of whom you know nothing and possibly you may care to hear something about them

This simple little allegory will I believe be helpful to me in making clear one or two points more especially with reference to procedure. Note in the first place that the enormous gain in knowledge and doubtless in material profit enjoyed by B was derived from and entirely dependent upon his procedure. A's procedure on the other hand is incapable of teaching him anything and so long as he persists in it he will remain steeped in ignorance and content

Now comes the interesting question what will A do? The following courses are open to him and great issues (for him) will hang upon his decision

1 He may frankly accept the new knowledge and at once adopt the new and highly advantageous procedure

2 He may express himself as convinced by the logic of B's arguments and by his pro-

cedure but prefers to go on sailing to and fro between Europe and the East because he has got along very well that way hitherto and he feels moreover that it is on the safe side

3 He may simply disbelieve B

Now I intend to show that in the choice of procedure for the cure of inguinal hernia surgeons are in the position of having to choose one of three courses exactly analogous to those set forth above for the mariner and the worst of it is that the enormous majority have chosen the second course with the result that they fling away all the advantages offered by the first including the essential knowledge of the precise nature of hernia

Let me now instead of two mariners suppose two surgeons A and B who started 30 years ago operating for the cure of hernia. Both had been trained in the theory of hernia universal at that time viz that hernia was typically caused by muscular weakness that it might appear either internal or external to the deep epigastric vessels that it might also sometimes enter an open funicular process and that it was a thing of curious and puzzling variations and so on an unintelligible muddle in fact with a go as you please nomenclature in accord

We may suppose that A and B each operate upon an ordinary case of oblique inguinal hernia the two cases being precisely similar in every respect. A does an operation involving of course removal of the sac followed by some suturing method B on the other hand for reasons of his own is content with removal of the sac alone. In both cases complete and permanent success follows. Now are we to conclude that both methods are equally right because the results are identical? As well maintain that both our mariners were equally right in their procedure because they both got to and fro between Europe and the East. Surgeon A will have learned nothing but will be simply confirmed in his erroneous belief as to the causation of hernia B on the other

hand will have gained knowledge of the startling fact that it was the sac and not muscular weakness that had been the cause of the hernia in his case clearly the muscles were in no way at fault or there would infallibly have been recurrence A and B go on operating until they have each operated on say 1000 cases of inguinal hernia of all varieties From this experience A will have learned nothing worth knowing and for this he has to thank his procedure and nothing else he will it is true have discovered that the results of his operations are vaguely precarious that for some reason they sometimes fail why he does not know The removal of the sac with him is merely an incident of the operation the stitching is the thing and his ambition is to devise some ingenious and fanciful way of suturing the muscles that will do away with recurrences and perhaps shed lustre on his name (for a time)

Let us now turn to B who with opportunities for observation in no way superior to those enjoyed by A has arrived at conclusions that place him in a very different position He has learned a great deal about inguinal hernia that he never suspected when he began and here are the main and most instructive facts

1 Spontaneous hernia is of two kinds saccular and non saccular

2 In saccular hernia removal of the sac will cure the hernia in non saccular hernia removal of the sac is useless

3 The typical forms of saccular hernia are (a) oblique inguinal (b) femoral (c) a rare form of direct hernia that enters a small congenital sac coming through the conjoined tendon (d) Probably all other varieties of spontaneous hernia with the exception of ordinary direct hernia

4 The typical form of spontaneous non saccular hernia is the ordinary direct hernia of middle and later life this must be carefully distinguished from 3 c

So that the distinction between oblique and direct inguinal hernia is wide as the poles it is clearly not a matter of the hernia coming down inside or outside the deep epigastric vessels by any sort of mere chance Oblique hernia is always saccular and is never due to

muscular weakness inguinal hernia that is really due to muscular weakness is always direct and ordinary direct hernia is always due to muscular weakness

Now all this important knowledge that has become a matter of commonplace observation with B has been entirely missed by A who has been the helpless victim of his own procedure For years he has gone on operating for inguinal hernia (as though inguinal hernia were a uniform entity) by his suturing method drawing entirely wrong conclusions both as to the causation of hernia and the reasons for his own successes and failures always believing that oblique inguinal hernia is mainly due to muscular weakness and believing he is curing his patients by his clever suturing noting that for some reason he does not understand direct hernia seems more refractory to cure than oblique and being content with that observation about which B could have enlightened him missing his opportunities in fact exactly as did the manner who was content to go to and fro rather than circumnavigate the earth

It is idle to argue for one moment that suturing up the canal does no harm it does immense injury both to the surgeon and in the aggregate to the patients Look at it from a logical standpoint and as affecting the patient only I have said and it is beyond question true that oblique inguinal hernia is never caused by muscular weakness therefore the muscles are perfectly efficient to prevent the return of hernia when the sac is removed Given then perfectly adequate (or at any rate sufficiently adequate) muscles are we to suppose that they are likely to be improved strengthened and made more adequate by stitching them firmly down to Poupart's ligament? When put in that way the procedure suddenly seems laughable does it not? And it is truly ridiculous Moreover it has been abundantly shown by experience that surgeons who operate by a suturing method do not acquire the art of removing the sac with nearly the same completeness as those who operate by removal of the sac alone The fact that surgeons who operate by suturing methods rarely if ever remove the sac completely is shown in a peculiarly exasperating

way when they decide to *give simple removal of the sac a trial*. The trial always results in failure because they remove the sac in the way they have been accustomed to remove it which is an imperfect way so they go back to their suturing methods having done more harm than good. From this it would appear that the suturing is apparently of some use when the first stage of the operation has been ineffectively performed it must be regarded therefore as a means for repairing the surgical deficiencies rather than for repairing the hernia. Now I do not wish to give you only a mass of destructive criticism which is always more or less easy. Let me try to be constructive and give you something that will be of positive and direct help in the performance of an operation for oblique inguinal hernia as I want you to do it. We will assume that you have already started on your operation and have got as far as exposure of the canal by incision of the external oblique and that you have found and are beginning to isolate the sac. Now

1. Seize the sac in a pressure forceps and pull it forcibly out strip the structures of the cord completely away from the sac and abdominal peritoneum and thus involves working deeply in the abdomen free the neck of the sac by sweeping the finger all around it.

2. Twist the sac tightly up until practically you can twist no more pulling forcibly upon it all the time. This will insure that the entire sac will be torsioned up to the point where it comes off from the abdominal peritoneum and it is at this point that the ligature must be applied.

3. Do not transfix with a needle apply a crusher of some sort to the spot where the ligature is to go below the crusher throw the ligature (catgut always never silk) which will slip into the crush as the instrument is taken off.

4. Nothing more will remain to be done except to repair the incision in the external oblique. Personally I prefer to do this by merely including it in one or two of the stitches employed for closure of the outer wound.

I attach great value to the tight torsioning and forcible pulling on the sac also to non

transfixion and the use of catgut always as a ligature.

In conclusion I should like to give you a few facts of interest about the subject of hernia in general and in particular about the causes that have brought me here this evening. It is all traceable to so far back as the year 1891 when I was appointed a surgeon to the Children's Hospital in Melbourne. At that time our guiding principle was based on the theory that hernia in childhood was often curable by the use of a truss and that operation should never be undertaken until truss treatment had been patiently tried. As to the exact indications for operation and the nature of the procedure to be carried out the surgeon had a wide range of choice and was practically fancy free.

As to the nature and causation of hernia it was vaguely regarded as being of the nature of rupture or giving way of the muscles at the same time it was recognized that the processus vaginalis might play a part by providing a pre-existing sac for the hernia to descend into. Where the processus vaginalis was completely open from abdomen to tunica vaginalis testis there could be no mistake as to the nature of the sac of the hernia but where the funicular process had been partially obliterated so that the tunica vaginalis testis was shut off the hernia could not then be distinguished from the ordinary acquired hernia of tradition. In other words there were two varieties of oblique inguinal hernia radically opposed in origin and nature yet practically indistinguishable from one another. But if these two totally different varieties were indistinguishable what conceivable ground could there be for believing that both of them existed why should they not be all of one kind or all of the other? Clearly there could be only one way of differentiating between the two kinds viz. to remove the sac and see what happened. Any individual case of hernia that was of the traditional acquired type due to muscular weakness would be practically unaffected by removal of the sac and would infallibly recur on the other hand if recurrence did not take place that would be clear proof that the sac must have been the cause of the hernia. It was very soon learned

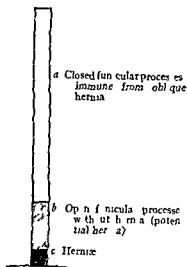


Fig. Diagram representing the funicular processes of any given number of people

at the Melbourne Children's Hospital that all inguinal hernia in childhood is funicular in origin and that the acquired form is non-existent. Consequently we were enabled to revise our entire theory and practice in children's hernia. The accompanying simple diagram will help to make the matter clear (Fig. 1).

The column represents the funicular processes of any given number of people in at least 10 per cent of people at a moderate estimate one or both funicular processes are imperfectly obliterated leaving the conditions ready for the occurrence of hernia so we shade the lower one tenth of the column to indicate the open funicular processes. Thus we have an upper nine tenths of the column representing children immune from hernia and a lower one tenth representing those predisposed to the subjects of potential hernia. Now 2 per cent of children get inguinal hernia and these we place provisionally in the predisposed category. If we contemplate this diagram we arrive inevitably at the following momentous conclusions:

Male mankind is divisible according to the diagram into three groups

1 With perfectly closed funicular processes (immune from oblique inguinal hernia)

2 With open funicular processes without hernia (predisposed to hernia)

3 With open funicular processes with hernia

Now we were able to make an exact estimate of the value of truss treatment which had always been our sheet anchor and we saw that the utmost that could be achieved after a most laborious and uncertain course of treatment was to transfer the child from Class 3 to Class 2 whereas removal of the sac could alone and at once transfer him to the most desirable category Class 1. To make a long story short this reasoning proved to be right in every particular and for a great many years past the truss has fallen into complete disuse at the Melbourne Children's Hospital. I am unable to say whether there is any other Children's Hospital in the world where this is so but so far as I can gather I am disposed to doubt it.

Thus we regard hernia in a child as a defect remediable by removal of the sac and not properly speaking remediable in any other way and every child without distinction of age that is brought with a hernia has the sac removed as a matter of course. There is nothing more striking than the way in which an ill-nourished constantly screaming infant with double inguinal hernia will be transformed into a comfortable prosperous baby immediately after the double rupture has been operated on. Finally having arrived at this point through experience gained in work among children in the year 1901 I was suddenly transferred to the staff of a general hospital and you may imagine with what interest I scrutinized the hernia of the adults who now came into my hand. Let me say at once that there is no etiological difference between the hernia of children and the hernia of adults: oblique inguinal hernia in adults as in children is never anything except funicular in the male and it is cured by removal of the sac if efficiently done just as surely in the adult as in the child. Direct hernia (the ordinary form) is an affection of middle and later life mostly and is of course not seen in childhood; the rare saccular form of direct hernia (*vide supra*) might no doubt occur in childhood but I have never met with it. For

the rest the main differences will be those due to long duration of the hernia in the adult with stretching of the musculature. In special cases of this kind the surgeon may think it wise to do a little suturing of the musculature but he will find his inclination to do this decline with experience when once he has acquired the habit of a sound method of operating by removal of the sac alone. In conclusion I would point out that whereas one is accustomed to look upon knowledge as an essential preliminary to procedure in this particular matter of hernia it would seem that knowledge of hernia is dependent upon and comes after procedure and this is so. Unless surgeons make up their minds to alter their procedure abandoning altogether all forms of suturing operations for oblique inguinal hernia they will never distinguish between the saccular nature of oblique hernia and the non saccular nature of direct hernia. And that distinction fully grasped is the basis of all real understanding of the problems presented by every form of hernia wherever occurring.

I have some regret that time will not permit me to do more than allude to the other most important form of saccular hernia—the femoral variety in this the sac is formed by inclusion of a peritoneal pouch in the sheath of the femoral vessel. The direct evidence in favor of this is clear and to my mind completely satisfying and its recognition is of the utmost importance. The practical deduction is that none but the simplest form of technique for removal of the sac should be attempted here for there is no friendly musculature to cover up surgical errors as is the case with the inguinal region. My object in this address has been to sound an alarm and let me say that I myself feel profoundly alarmed. What I have seen of late convinces me that in the

matter of hernia we have practically stood still for the last 30 years and that neither the operative treatment nor our theoretical grasp of the nature of hernia has advanced materially. And the reason for this? In one word—procedure. Surgeons must alter their procedure in the way I have indicated must give up treating oblique inguinal hernia by any means other than simple removal of the sac without suturing. Unless this is done there will be no more advance in the next 30 years than in the past and until it is done there will be no advance at all. I am glad to have the opportunity of saying this to American surgeons not merely because I myself hope to have the honor this week of becoming an American surgeon but even more with the assurance that what I have said will appeal to minds that are reputed and rightly reputed to be notable for openness and receptivity and independence. I shall probably never operate for hernia again but I must devote whatever time and energy may be left to me to a crusade in favor of a revised and correct procedure. And may I in conclusion tell you this once and finally at the risk of overemphasising the message I have come with. If you want to learn all that there is to be learned about hernia you will find that the key to the problem or series of problems is to be found in the operation for oblique inguinal hernia. You will be amazed at the revelations that will pour in upon you not only with respect to the different varieties of inguinal hernia but of other forms of hernia as well. For one thing you will soon come to smile at the thought of femoral or obturator hernia being anything other than of saccular origin and the knowledge gained is sure to lead you to the simplest and the most perfect operative methods.



whether it be a persistent or preformed structure these latter appellations indicating of course a congenital origin.

The actual etiology of such a sac is a matter of interest and must bear some relationship to the general etiology of all indirect inguinal herniæ. In 1817 Jules Cloquet said that the internal ring rarely closed at birth and that he had found in dissections a depression of peritoneum which he called the infundibular process of peritoneum.

Much has been written on the subject of this persistent infundibular process of the peritoneum notably Pussell (7, 8) who has published many articles on the sacular theory of the formation of hernia. His ideas are summed up in the following way. By the sacular theory of hernia I mean the theory that rejects the view that any hernia can ever be acquired in the pathological sense and maintains that the presence of a developmental peritoneal diverticulum or sac is a necessary antecedent condition in every case of abdominal hernia. In his specific reference to inguinal hernia he lists the following probable causes: (1) variations due to oblitative failure; (2) primary anatomical variations due to developmental accidents; and (3) developmental accidents resulting in the implication of an abdominal organ in the formation of the funicular process. And in relation to the muscular development of the abdominal wall he further says: We may have an open funicular peritoneum with perfectly formed muscles; we may have congenitally weak muscles with a perfectly closed funicular peritoneum; and we may have them separately or together in infinitely variable gradations.

During the past year Sir Arthur Keith (6) has published a paper which is largely devoted to the refutation of Russell's ideas. He feels that there is no evidence whatever from an embryological standpoint for the theory of the preformed sac. This argument in regard to herniæ other than those under consideration need not be discussed but there can be no denying the fact that at the internal inguinal ring there is the possibility of a persistent congenital structure. What the factor is that causes further development of this sac into a

definite clinical hernia is also of slight concern but the mention of a few theories might be made. Keith says that it is not 'continued degrees of high intra abdominal pressure' but minor and oft repeated impulses that produce the hernia. He also refers to the inguinal shutter which is formed by the muscular contraction of the anterior wall of the canal.

Hammond (4) explains the onset of hernia in a preformed sac as due to an acute incoordination of the muscles constituting the so-called sphincter of the internal inguinal ring; this occurs in strains etc. some viscus descending into the sac during this momentary period of relaxation. And Russell feels that the normally formed inguinal canal is endowed with a strength and retentive efficiency for resisting hernia enormously in excess of any demand that can be made upon it by the mere intra abdominal pressure unaided by the presence of a sac.

The actual frequency of occurrence of this preformed sac is rather difficult to estimate; some figures however are available which may bring light on the subject. Most of these figures have been derived from studies made on the cadaver. Pow examining 200 subjects found 47 potential herniæ. Keith found 120 in a thousand examinations of the inguinal canal in old individuals. Various other studies have shown an average occurrence of about 20 to 30 per 1,000 cases examined. It must be further emphasized that this determination cannot be made simply by examination of the living subject. These preformed sacs are not clinically demonstrable; therefore aside from the cases actually demonstrated at operation further evidence of their occurrence must be gained more or less by inferential methods.

Taylor (10) in a study of the results of operations for inguinal hernia performed over a period of about 20 years at the Johns Hopkins Hospital re-examined carefully 184 out of a total of approximately 1,000 cases. Of those cases which he re-examined personally and which had originally presented a unilateral inguinal hernia and undergone operation for its cure 29 (16 per cent) at a later time showed the presence of hernia upon the opposite side. As has been said above such evi-



dence is purely inferential but in the light of the observations here recorded would seem to be pertinent to the subject under discussion. In a few of these cases which later showed a hernia on the opposite side note was made at the time of the original examination of the dilated inguinal ring. Coley (1) reports that it is an almost daily observation at the Hospital for Ruptured and Crippled to find patients applying for operation or truss on one side when careful examination shows hernia on the other side almost if not quite as large as that for which treatment was sought. This is of course a common experience in any surgical clinic and is of importance in consideration of the occurrence of double inguinal hernia. Erdmann (3) in an analysis of nearly 1000 cases found that approximately 12 per cent of unilateral hernia cases returned at some later period for operation upon the opposite side. Twenty five per cent of his cases originally showed bilateral inguinal hernia a surprisingly large proportion. These two figures therefore would make a total of 37 per cent of his cases exhibiting at some period in their course of hospital observation a hernia upon each side. It is reasonable to assume therefore that the bilateral inguinal hernia is a condition of frequent occurrence whether both herniæ are present at the same time or not.

What bearing can the facts put forth have upon the operative treatment of hernia? Seelig and Chvike (9) say that nothing is pertinent in the operative treatment of hernia except (1) high ligation of the sac (2) adequate reinforcement of defective abdominal wall and (3) primary wound healing. These criteria would probably meet with fairly universal endorsement. Here again however there is a definite difference of opinion in regard to the most vital part of the whole procedure. Russell convinced of the importance of the preformed sac is content in his operations simply to excise carefully and thoroughly the hernia sac when found thus restoring the normal tension of the parietal peritoneum. He feels that the measures used to strengthen the inguinal canal are not essential and presents impressive figures to support his views. However he regards the absence of

symptoms for 1 year as evidence of cure. This period of absence of symptoms is obviously not long enough. In contrast to this opinion no case has been found showing a recurrence in which the inguinal canal has been strengthened as a result of finding a dilated ring although either no attention is paid to the possibility of a sac or else none was found when sought for. Admitting the probability of the presence of a sac in all of these cases we would have prevented under such circumstances the occurrence of a hernia without paying any attention to the presence of the sac itself. Data on this point however are not sufficiently reliable to warrant drawing any definite conclusion and the combined procedure of excision of sac with plastic treatment of the inguinal canal must continue as the operation of choice. In other words if anything is done it should be the complete hernia operation.

The advisability of urging the patient to undergo the combined operative procedure when only one hernia is present but when there is a dilated ring on the opposite side is open to question. This must be regarded from various angles. Will the advantage gained from strengthening the relaxed ring outweigh the possible disadvantage of the double operation? Certainly the figures quoted above indicating that 16 per cent of single hernia cases returned for operation on the other side make this a factor of considerable moment. The majority of patients would undoubtedly prefer to have whatever surgery was necessary done at one time rather than return for a second operation. In itself the double operation should not make the risk of surgery any greater but this fact alone is regarded by some as a definite contra indication to the combined operation. Bunts is opposed to operating on a relaxed ring on the opposite side unless it is very definitely indicated as it exposes the patient to the possibility of infection and the necessity of re operation for recurrence. It is perfectly true that infection in a hernia wound greatly increases this possibility of recurrence but we should certainly not adopt the attitude that slight prolongation of operation increases the risk of infection in clean hernia wounds. Hubbard (5) does not find that the double

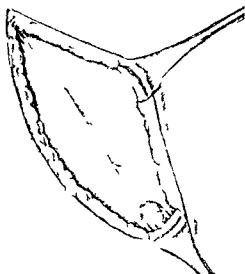


Fig 1 Hernotomy incision through skin subcutaneous separation of fibers of external oblique aponeurosis and slight incision of external oblique

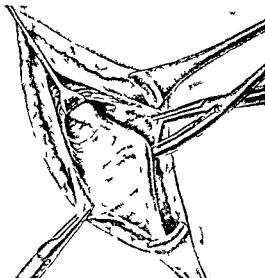


Fig 2 Hernotomy incision completed. Internal oblique fibers tracted upward and coiled to show small sac at internal ring

operation increases the risk of wound infection but does feel that it causes more frequent pulmonary complications

In order to obtain if possible some light on this subject 100 consecutive double herniotomies were analyzed for postoperative complications. In these cases a number of operators over a period of several years and different anesthetists were involved. All patients had ether anesthesia. In this group it was found that 5 wound infections occurred 1 of these being only a slight stitch abscess. Surprisingly enough all of the infections occurred on the first rather than the second side. Such a thing is difficult to explain but nevertheless is the fact and certainly offers no evidence that the double operation increases the risk of infection on the second side. In this series also there occurred 4 postoperative pulmonary infections. 2 of these were of short duration and could hardly be called definite pneumonia while the other 2 had before operation a chronic bronchitis. There were no deaths from pneumonia. In three of the cases the operation lasted for about 2 hours while in the fourth the patient was under the anesthetic for only 1 hour all of the patients were 35 years or over.

To form a basis of comparison a similar number of single herniotomies was examined for postoperative complications and it was found that the same number of wound infections occurred but only one postoperative pneumonia. We have therefore no difference in the incidence of wound infection in the two series but in the double herniotomies four times the number of pulmonary complications. Of course these two series are really not large enough to permit of any definite conclusion but can simply be regarded as suggestive.

Decker (2) in a compilation of postoperative complications of the respiratory tract from all types of cases occurring in different hospitals of the country found that the morbidity percentage in 6 institutions ranged from 1.2 to 3.52 per cent this highest figure corresponding very closely to the 4 per cent in this series of double herniotomies. It is difficult to explain the apparent increased incidence in the double operation. Various theories have been advanced but none is entirely satisfactory. Possibly if more pains were taken in the preoperative preparation of hernia patients the incidence would be reduced. These patients are ordinarily not ill

and we are not apt to regard the operation as a matter of such particular moment as to make so careful a preoperative examination for mild upper respiratory infections. And finally in this general connection the patient's convalescence must be considered. A perfectly uncomplicated postoperative course in a case of double herniotomy need be no longer than that of a single herniotomy. In other words the two wounds will heal just as quickly as one.

#### DISCUSSION

Admitting only the fact that there is some slightly greater risk of a pulmonary complication in individuals upon whom a double herniotomy has been performed it certainly seems that the added advantage of obviating the very considerable risk of a second operation should more than outweigh this one fact. The question of infection can be dismissed and should of course be reduced in both types of cases by careful technique to an absolute zero. The incidence of infection in the cases reported is certainly far too high. In the 5 infections in the double hernia series 3 occurred in a group performed by one particular individual. It seems fairly well established by the presence of the preformed hernia sac described above that certainly in the inguinal region there has been advanced further confirmatory evidence of the theory that these herniæ all occur as a result of the presence of this persistent peritoneal funicular process. Further interesting evidence on this point might be gained by an examination of the internal ring during all laparotomies. However it is rather doubtful that such a small opening and so small a sac could be recognized unless the internal ring could actually be seen and this of course in many laparotomies is quite impossible. Such examinations have of course been made by various people in a more or less careful way but no evidence of any particular value has been obtained. It will be extremely pertinent to follow some of the cases with simple tightening of the external ring in which no regard was paid to the possibility of the peritoneal sac.

Should none of these cases later on develop actual hernia as they would be expected to do

if ligation of the sac is so important a part of the general operative procedure it would indicate that in certain herniæ at least sac ligation is not of such great importance. On the other hand recurrence or at least appearance of the hernia would have a most important bearing on the whole subject.

#### CONCLUSIONS

1 In a series of cases in which the inguinal canal was opened on account of a relaxed ring and in which no clinical evidence of hernia was seen in every instance a small persistent sac has been found.

2 Analysis of a group of cases shows that 16 per cent of individual presenting hernia on one side eventually develop hernia on the opposite side.

3 It is felt that correlation of these facts lends further strong support to the preformed sac theory in regard to the etiology of all inguinal herniæ.

4 A study of 100 consecutive cases of both single and double herniotomies has shown that the double operation increases the incidence of postoperative pulmonary infections but it does not increase the incidence of wound infection.

5 If any operative measures are used to repair the relaxed ring a complete herniotomy should be performed.

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## A PRIMARY SPINDLE CELL SARCOMA OF MECKEL'S DIVERTICULUM

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CL 1461

**M**ECKEL'S diverticulum is of rare occurrence being said to appear in approximately 2.7 per cent of all individuals. (3) Malignant tumors of the small intestine are uncommon probably composing not more than from 2½ to 3 per cent of all tumors of the intestines. (1) It would be expected therefore that malignant tumors of Meckel's diverticulum would be exceedingly rare in fact in a review of the literature we find but few reported cases among which we have been able to discover only seven reports of malignant tumors of Meckel's diverticulum and only three of these were cases of undoubted sarcoma. To these we wish to add the report of a fourth case of sarcoma.

The patient a woman age 41 years consulted Dr. Crile because of intestinal obstruction. The important points in the history as taken on the admission of the patient to Lakeside Hospital are as follows: Soon after the birth of her first child she began to have attacks of pain in the lower abdomen and back. The pains were periodic and grew worse and more frequent until the appendix tubes and ovaries were removed. After this operation she remained well for the next 5 years when 8 months before her admission to the hospital she again had attacks of cramp-like pain across the lower abdomen the pain radiating toward the epigastrium. At first these pains would appear after meals but later they had no definite relationship to eating. Sometimes there were periods of several weeks during which the patient would be free from discomfort. During the 2 months before she entered the hospital the attacks had been more frequent and more severe. At times they had been accompanied by nausea but she had omitted only once or twice. Occasionally the abdomen had been distended and very tender. The patient had been constipated and had had frequency of micturition after the attacks but no sensation of burning and no hæmaturia. There had been some loss of weight and strength. The physical examination showed only the usual signs of partial intestinal obstruction considerable tenderness and distention of the abdomen and a small palpable tumor which was fixed in the right iliac area. Examination of the urine elicited no evidence of disease in the genito-urinary tract. A pre-operative diagnosis of complete intestinal obstruction was made.

*Operation by Dr. Crile.* When the peritoneum was opened considerable free fluid was caped. This at first was dark and slightly blood tinged and later con-

sisted almost entirely of blood which had the appearance of having been in the abdomen for at least a week. A tumor as large as a pear was discovered which was adherent to the omentum and arose from a pedicle of the ileum at a point opposite its mesenteric attachment. The pedicle was cut away and the raw area closed over. The tumor was removed from the omentum by tying off and severing its attachment. No other pathological condition was found so after ridding the peritoneal cavity of blood the abdomen was closed.

*Pathological report:* The specimen as submitted to the pathologists Dr. Allen Graham and Dr. F. Shbach who made the following report: The specimen consists of a diverticulum from the small intestine and a tumor mass. The diverticulum is about 6 centimeters in length and 2.5 centimeters in diameter. It is quite firm and indurated at the tip and there are some adhesions. The tumor mass which was attached near the tip of the diverticulum was entirely within its lumen. The tissue is soft friable reddish gray translucent and homogeneous on the cut surface. The inner lining of the diverticulum has in many places small grayish granular masses which are adherent to the wall and have the appearance of a papillomatous growth. Gross diagnosis: malignant tumor of the small intestine and diverticulum—probably Meckel's.

*Histological description:* The sections show a tumor composed in the main of rather large spindle cells although cells of many forms are mingled among these. Large irregular areas of hyaline connective tissue are scattered irregularly in the mass. In these connective tissue areas are many large blood vessels some of which have thick walls. There are a few blood sinuses with only an endothelial layer of cells forming the walls. The tumor cells vary in shape and size but in the main are large spindle cells and show a large excess of chromatin with occasional mitotic figures. Scattered diffusely among these are polymorphous cells few in number (Fig. 1). Histological diagnosis: spindle cell sarcoma.

When all evidence of peritoneal inflammation had subsided the patient was given a full course of deep X-ray therapy by Dr. Portmann at the Cleveland Clinic. The entire abdomen back and liver area were included in large field less than one half of the skin dose being given to each area on succeeding days. There was slight nausea following the treatment of the liver areas but otherwise the patient was not inconvenienced.

The patient was recently seen in February 1925 more than a year since the X-ray treatment was given. At this time she was very well had gained considerably in weight and showed no evidence of any tumor or metastases.



Fig. Sp. dl. cell. d. sar. ma. of Meckel's d. diverticul. m.  
Ph. 1 microgr. ph. of se. ti. X300

It is obvious that the various pathological conditions associated with Meckel's diverticulum such as inflammation ulceration perforation intussusception volvulus incarceration and the presence of neoplasms are of considerable clinical importance. Unfortunately however they are not diagnosed except at operation or at autopsy. In the presence of any obscure abdominal condition therefore especially in one that simulates appendicitis or in cases of obstruction a surgeon should bear in mind the possibility that a Meckel's diverticulum is involved. Therefore when at operation it is found that the appendix or other organs are not at fault the last 3 feet of ileum where a Meckel's diverticulum occurs should be explored. It is stated by Mumford that this diverticulum is responsible for 6 per cent of all cases of obstruction and that inflammation has been present in 13 per cent of the reported cases of Meckel's diverticulum (7).

The structure of Meckel's diverticulum is similar to that of the appendix but perhaps contains more of the glandular structures. It would appear therefore that the tumors of the small intestine which might occur in

Meckel's diverticulum would be benign tumors of a cystic nature fibromata adenomata myomata lipomata papillomata and angiomata. A benign carcinoid tumor has been described which has the appearance of pancreatic tissue or of an accessory pancreas. The malignant tumors such as spindle cell sarcoma lymphosarcoma endothelioma melanoma sarcoma carcinoid tumors or malignant degeneration of a myoma are exceedingly rare.

#### PREVIOUSLY REPORTED CASES

As stated above we have been able to find only 7 previously reported cases of malignant tumors of Meckel's diverticulum of which only three were sarcomata.

The first mention of such a case which we have discovered is a statement by Kaufmann (6) that the Basle collection contained a specimen of a spindle cell sarcoma of a Meckel's diverticulum.

In the same year 1911 Tschknawerow (9) reported a sarcoma of Meckel's diverticulum in a woman 62 years of age discovered at autopsy. He also states that the only like case he had been able to discover in the literature was that mentioned by Kaufmann.

In 1913 Haessner (4) again reviewed the literature adding to the two cases cited above one reported by Fried in 1902 as a myosarcoma or fibrosarcoma arising from a point opposite the mesenteric attachment of a Meckel's diverticulum. Haessner adds a case of his own which he describes as a rapidly disintegrating apparently malignant tumor in the region of the ileum adherent to a Meckel's diverticulum. While it is stated that it is doubtful whether or not the primary site of this tumor was in the intestines or the diverticulum the author believes that it was the latter.

Symmers (8) studied a case of malignant leiomyoma springing from the base of a Meckel's diverticulum. In his review of this subject he stated that he had been able to find only one similar case in the literature that reported by Fried.

In 1919 Black (2) reported a case of a potentially malignant growth in a Meckel's diverticulum apparently papillomatous which arose from the tip of what he considered a congenital diverticulum of the sigmoid.

Braxton Hicks and Kadinsky (5) (1922) have reported a case of carcinoid tumor of a Meckel's diverticulum in which the submucosa showed a mass of glandular tissue somewhat resembling shrunken pancreatic tissue which did not penetrate into the underlying fibromuscular structures

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## RETROPERITONEAL CYSTS

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**R**ETROPERITONEAL cysts are infrequent surgical occurrences. Those tumors posterior to the peritoneum whether they are cystic or solid tumors of the liver, pancreas, kidneys, adrenals, mesentery, lymph nodes, lymphatics or omentum are of sufficient rarity to make the report of cases of more than incidental interest.

From an embryological and anatomical viewpoint they are of considerable significance. As a rule they are met with by surgeons in patients who come complaining of either a localized or general abdominal enlargement. The case presented and the comments following deal with a cystic tumor of the retroperitoneal space not attached to any solid or hollow viscus but supposedly originating in vestigial remains of fetal structures.

## REPORT OF CASE

The patient is a boy of 3 years of age. He was admitted to the Second Surgical Division of the Roosevelt Hospital October 22, 1913, complaining of swelling of the abdomen. The family history is relevant. About one year ago patient had swollen glands in neck. These lasted 3 weeks but did not break down. At the age of 4 months patient had whooping cough, measles and chicken pox one following the other.

Present illness began 9 days ago when patient's mother noticed that his clothes began to fit him very tightly around the abdomen and that there was definite increase in the size and prominence of

his abdomen. Coincident with this was a noted loss of appetite but at no time did patient complain of any pain. He was not confined to bed but appeared well and played about the house all day. Sleep was undisturbed. The bowels were regular, moving once or twice a day. Father of patient thought that upon one occasion the stool had a reddish brown appearance. Father states that patient was jaundiced for first 7 days of present illness. He presents icteric tint to face and sclerae of eyes. The abdomen became progressively larger.

**Physical examination.** Patient appears to be a well-nourished but decidedly pale and sick-looking child with anxious face and bulging abdomen. Tonsillar and posterior cervical and inguinal lymph nodes are enlarged but not tender. The heart is normal throughout. The lungs present a few moist rales heard over the posterior chest. Rectal examination negative. The abdomen is markedly protuberant, more so on the right side than on the left and does not move with respiration. No definite mass or peristaltic waves are seen. The umbilicus bulges slightly. The abdominal wall seems tense throughout but there is added rigidity on the right side in both upper and lower quadrants. The circumference of the abdomen at the umbilicus on admission was 55 centimeters; on October 31, the day prior to operation, 57 centimeters. The whole right side gives one the impression of a markedly distended mass as if it might be a distended ascending colon or a cystic tumor. The spleen, liver edge and kidneys are not felt. No shifting dullness or fluid wave could be heard. Nothing could be heard on auscultation. The urine is negative. X-ray examination after colon enema shows that the barium passes back to the hepatic flexure at which point it abruptly terminates. The plates suggest a lesion



Fig 1. Huge retroperitoneal cyst being examined by the patient's father.

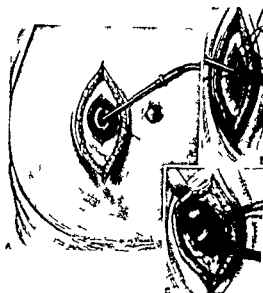


Fig 2. Incision through the abdominal wall showing the cyst wall and its contents. The cyst wall is being manipulated with surgical instruments.

at this point. On admission hemoglobin was 45 per cent, white blood cells 8000, polymorphonuclears 67 per cent. The stools were yellow in color with much fat, no bile, no blood, no ova or parasites. Von Birquet test negative.

Note made on October 30, days prior to operation. Patient's temperature has gone up to 101.6 degrees, pulse 132, respiration slightly increased, white blood cells 10000 and polymorphonuclears 80 per cent. He looks very sick, pale, apathetic, refuses food and complains of pain in abdomen. The abdomen seems more tense. Definite tenderness is elicited in the right upper and right lower quadrants as well as in the epigastrium. The lungs are clear. Patient complains of gratification. Colon irrigations and turpentine stupes relieve him of considerable flatulence but very little fecal matter was passed. It was thought that operation on abdomen was imperative.

Preoperative diagnosis: tuberculous peritonitis.

Operation. On November 1, 1923, under light drop anesthesia, an incision approximately 4 inches long was made to the right of the midline, center of incision being at the level of umbilicus. The peritoneum was opened. No fluid escaped. No intestines were seen but a dark bluish red membrane containing numerous blood vessels presented into the wound. On retracting the wound upward the cecum, appendix, and right colon were found pushed high up under the liver and spread out over the dome of a great cyst wall. The mass of the cyst had apparently

pushed the posterior peritoneum for a distance. Coils of small intestines lay to the left of the bulging cystic tumor. Stomach, liver, and gall bladder appeared normal on palpation. The right kidney could not be felt as the distended cyst interfered with the palpation of this organ. The cyst extended downward to about the level of the false pelvis. It was easily seen that it was impracticable on account of the patient's condition to remove the entire cyst, so it was decided to evacuate the cyst and establish drainage. Patient's condition did not warrant much manipulation. A trocar puncture, as made and suction was applied and about 850 cubic centimeters of dark red fluid suctioned off. The trocar puncture wound into the cyst wall was enlarged to the extent of about 2.5 inches. A small piece of the cyst wall was removed for microscopic study. The opening in the cyst was brought up to the skin fully sutured to the peritoneum. Two fingers were inserted into the cyst cavity and two small cysts were opened into with the index finger. They lay one to the left and one to the right of the spinal column high up in the mother cyst. About 150 to 175 centimeters were evacuated from each of these smaller cysts. After removal of all fluid the right kidney could be palpated as normal. The left kidney was palpated with some difficulty but was thought to be normal. Wide gauze packing was inserted into the small cysts and also into the large cyst cavity. A small strip of gauze was placed in the lower angle of the abdominal wound. The wound and the abdominal

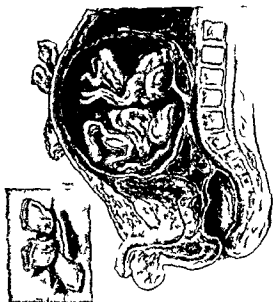


Fig. 3. Sagittal section showing packing in the retroperitoneal cyst and the other cysts. Inserted gauze packing protruding from wound.

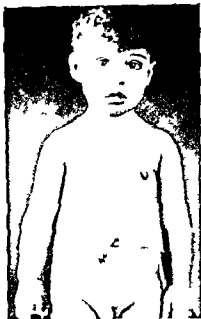


Fig. 4. Photograph of patient 2 months later post-operation.

wall were closed with continuous plain catgut to the peritoneum interrupted catgut to the fascia silk worm gut and silk to the subcutaneous tissue and skin. Patient's pulse which was 100 at the beginning of operation was 150 at the close. His condition seemed precarious and the effluent but little ether was given.

**Examination of cyst fluid.** Appearance bloody, specific gravity 1030, albumin present serum 1023. A smear shows red cells predominant, polymorphonuclears 74 per cent, mononuclears 22 per cent, transitional 5 per cent, many bacilli present also a few short chained micrococci. Culture of cyst fluid shows presence of bacillus coli and bacillus pyocyaneus.

**Postoperative course.** Convalescence was slow. During the first 8 hours there was very little reaction, temperature 102 degrees, respiration 40, pulse 14. Patient retained fluids by mouth and rectum. The first day after operation the temperature rose to 105.6 degrees and patient became delirious. Pulse was 100 and weak. Following this sharp reaction the temperature gradually fell, the pulse became slower and from then on patient continued to improve.

On the sixteenth postoperative day all drains were removed. Following removal of these drains some vile smelling pus was expressed from the wound. The wound was still discharging and in good condition.

December 14, 1923, patient was sent home pronounced cured, having been in the hospital over a period of 53 days.

**Recall note.** January 4, 1924, Patient returned to hospital with wound entirely healed. There was no discharge whatsoever. He has gained weight, the bowels are regular and he is in excellent health.

January 18, 1924, Patient returned to hospital again. No complaints to make. He eats everything and sleeps well and is apparently in the best of health. The wound is firm and there is no evidence of herniation. He was told to return in 6 months for a second official recall.

July 20, 1924, patient has gained in weight, is in excellent health.

December 1, 1924, in every respect patient in normal health. He is still gaining in weight.

There are but few cases like the one described above found in the literature of this country. For the most part retroperitoneal cysts have been reported in foreign literature.

Koenig (8) gives due credit to Roth as the first to point out the origin of these interesting cysts as having sprung from the wolffian body or the muellerian ducts. Lobstrum (10) was the first to describe in any detail tumors of the retroperitoneal area.

In the literature carefully reviewed the case most similar to my own (as reported above) is one reported by Simpson (14). His case was a girl of 6 with a symmetrical enlargement of the abdomen since the age of



two increasing noticeably. The mass filled the whole lower abdomen and extended upward to a point halfway between the umbilicus and the ensiform. The palpating hand sensed deep seated fluid under tension. The pre operative diagnosis was large ovarian cyst. Operation disclosed a large retroperitoneal cyst containing 45 ounces of thick brown fluid. The cyst was one half inch thick. The entire cyst wall was removed in two stages it being very adherent posteriorly to the aorta, vena cava, iliac vessels, ureters and vertebral bodies. Recovery was complete. Excellent cure.

Ashhurst and McGuire's (1) case was an adult woman of 26 years with a history of sharp pains in right side of abdomen for 3 years brought on by lifting a heavy weight taking a quick step upstairs or turning suddenly in bed. A mass of the size of a lemon was palpated in the region of the cæcum. Pre operative diagnosis was chronic salpingitis and retroversion of the uterus. At operation a fetal head sized retroperitoneal mass was found in the right fossa extending from the brim of the true pelvis to just below the right kidney. The cyst contained clear fluid like spring water. The cyst wall was enucleated. Immediate and permanent cure was effected.

Maury (11) reported an unusually large cystic tumor in a woman of 28 years extending from the pubis to the costal margin with no demonstrable pedicle. Yet while dissecting free the lower pole a tubular structure was found which he traced down under the sigmoid and out into the broad ligament there ending half way between the uterus and the pelvic wall. He believed that this terminated in the parovarium.

Lafontaine (9) publishes a case of a woman 43 years old with a double retroperitoneal cyst, one voluminous cyst in the left flank and the other a smaller one in the right iliac fossa both situated in the retroperitoneal space. Complete removal of both cysts was accomplished. These cysts were lined with cuboidal epithelium with slightly staining nuclei and protoplasm deeply stained with eosin. The epithelium closely resembled that of the glomerulus or canals of the wolffian body.

There are numerous other interesting cases reported but the ones quoted above seem sufficient to show the typical cysts of the space posterior to the peritoneum.

#### PATHOGENESIS

The origin of the cysts forms the most interesting phase of the entire study notwithstanding the fact that the diagnosis is both puzzling and difficult. The treatment is simple and the prognosis easy. There is varied speculation as to exactly which structure posterior to the peritoneum they arise from yet it is agreed almost universally that they spring from some portion of (a) the developing urogenital tract or from some variation in the (b) developing retroperitoneal lymphatic system. It is from these two (a) and (b) that most of the large and interesting cysts arise. However it is worth noting that some have grown from cell inclusions (c) the dermoid or teratomatous cysts are composed of a thick walled cyst containing teeth and hair and grumous material (d) the blood cysts as the name implies are huge cystic collections of extravasated blood in the retroperitoneal space due to injury of blood vessels of the retroperitoneal space (e) the parasitic cysts reach the area either by going directly through the intestinal wall into the retroperitoneal space or by the blood stream (f) the mesenteric cysts lie between the leaves of the mesentery of any part of the bowel more commonly between the fold of mesentery of the ascending and descending colons. Dowd's (3) splendid contribution to the subject of mesenteric cysts should always be looked into when one is interested in this particular type of cyst.

In the developing urogenital tract which is exceedingly complicated with great numbers of tubules and other fetal structures which undergo cystic degeneration and then disappear it seems ample opportunity is some times afforded for one of the tubules not to disappear by cystic degeneration but to develop gradually into a retroperitoneal cyst. In view of this it may be of interest to state briefly the development of the genito urinary system for surely these cysts for the most part come from persistent developing fetal remains of the pronephros, the mesonephros.

and the metanephros. Particularly is it believed that they originate from the wolffian duct which is the primary excretory duct of the pronephros and the mesonephros or from the muellian duct which is formed from invagination of the coelomic mesothelium into the superior aspect of the urogenital fold at about the level of the third segment.

Cysts which are conclusively proved to arise from the wolffian body show primitive glomeruli and kidney tubules in some place or places in the cyst wall. Hinman, Gibson and Kutzman (7) state:

Literature however abounds with reports of cysts which present none of these structures but are considered as being of wolffian origin—either mere supposition or reason by process of elimination. A greater number of retroperitoneal cysts occur in the female than in the male. It is supposed that a greater amount of wolffian body remnants exist in the female than in the male.

*A Pronephros* The pronephros with the pronephritic duct is the first of the urinary organs to appear. It is transitory—seen first in the 173 millimeter embryo and disappears by the time the embryo has developed into the 49 millimeter stage. The pronephros and the mesonephros have a segmental arrangement. The mesonephros segmentation begins at the vertex end and develops caudally until complete; likewise pronephric rudiments begin in the head region; the first tubules being so short lived that they are undergoing degeneration when the caudal ones appear. Pronephric tubules do not exist beyond the twelfth primitive segment. In the growing embryo the twelve segments eventually correspond with the bursa omentalis and it is for this reason that pronephric remnants are likely to be the origin of some retroperitoneal cysts.

*B Mesonephros* The mesonephros which constitutes the second set of urinary organs appears immediately following the pronephros. From the mesonephros are developed the genital glands and all tubular structures in the region of the broad ligament in the female arising particularly from the paro-genitalis tubules (the lower group of tubules from the seventieth to the eighty third) and

it seems likely that retroperitoneal cysts in the pelvis must have their beginning in these early mesonephric structures which have not completely degenerated. Felix (4) states that 57 out of 83 mesonephric tubules degenerate and supposedly disappear entirely. They all lie posterior to the peritoneum and some no doubt fail to degenerate and proceed on to the development of cysts.

*C Metanephros* The metanephros or kidneys is the third set of urinary organs to develop. It is divided into the excretory and the efferent systems. The excretory duct arises from the nephrogenic cord and this duct in conjunction with the ureteric bud develops various sets of tubules. Finally twelve orders of tubules are formed, each with its own excretory cap, the kidney being formed from a coalescing of the branches of the ureteric tree and islands of excretory tissue. Bowman's capsules and uriniferous tubules are derived from the excretory caps. It is in the union between terminal collecting tubules and the uriniferous tubules which is a complicated process that variations and disturbances of development may give rise to marked anomalies (6). The lymphatic system as Sabin (13) has shown is in part derived from the veins or in other words lymphatic vessels are modified veins. In the early stages there are series of isolated lymph sacs which beyond question are derived from veins and later on the thoracic duct connects all these sacs—one with the other. There are four of these sacs: (1) The jugular sac lined with endothelium is filled with blood and lies close to the jugular vein. (2) the retroperitoneal sac in the abdomen opposite the lower thoracic and upper lumbar vertebrae. (3 and 4) pelvic sacs lying posteriorly on either side of the pelvis. In the connecting up of the lymph sacs or later when the lymphatic capillaries and lymph nodes are being formed, any error in development at this stage could easily account for the presence of a chyle cyst in this area.

Baetzer (2) has demonstrated in the embryo pig a direct communication between the lymph sac and the inferior vena cava. However the communications were only transitory. Sylvester (15) has shown that in

South American monkeys a permanent communication exists between the lymphatic and venous systems at the level of the renal veins. In this connection he says: "Whenever the mesenteric or inguinal lymphatic nodes of a New World species were injected the injection mass never passed from the lumbar or intestinal lymphatic trunks into the thoracic duct or into the anterior regions of the body, but passed directly into the postcava in the region of the renal veins. A more detailed examination of the vessels in this region of the body revealed the fact that the lymphatics of the digestive organs and of the posterior extremities invariably enter the venous system at the level of the renal veins."

In 1914 Halsted (5) removed from the abdomen of a woman about 40 years of age a large congenital lymph cyst in the right upper quadrant. The cyst was attached in two places to the inferior vena cava. In separating the cyst from the large vein in both instances blood gushed out through slits in the vena cava wall; the edges of the slits were smooth, the linear defect being clearly not due to a tear or a cut. Halsted's explanation of the presence of blood so often (as in my case) noted in these cysts is that a lymphaticovenous fistula exists and that blood appearing in the third or fourth tapping as is sometimes met with is due to a negative pressure within the cyst cavity following the tapping and this negative pressure opens up again these embryonic defective slits in the vena cava allowing blood to seep in. He felt that the explanation offered so many times for blood in these cysts to wit, trauma was insufficient.

#### PATHOLOGY

Cysts may be single or multiple. They are classified as (a) a single unilocular cyst (b) a single cyst with smaller daughter cysts rising from its wall or cysts in the larger cyst cavity (c) a mass of cysts of approximately the same size without any connections between them and not one of which can be called a mother cyst (d) multiple cyst adenomata. The wall is composed of fibrous tissue and the lining membrane may be loose or close connective tissue without epithelium as

seems to be usual in the true lymph or chylous cysts. Hygromata of the neck and the primitive lymphatic sacs are not lined with epithelium while in those cysts of urogenital remnant origin the lining membrane is made up of epithelial cells of the flat cuboidal ciliated or columnar type. The lining epithelium of the transverse tubules of the Wolffian bodies is more highly developed epithelially than the lining of the duct hence it is easily imagined that the simple cysts in all probability arise from the ducts while the adenomatous cysts arise from the tubules. The contents of the cysts are (1) lymph (2) blood (3) jelly like pseudo-mucin or colloid (4) hair teeth and grumous material as in the dermoid (5) parasitic elements (6) combinations of one or more of the above.

#### SYMPTOMATOLOGY

The most frequent symptom is either a localized or general increase in the size of the abdomen or occasionally localized pain or pain referable to pressure on the dorsal nerves. When these tumors are situated in the pelvis and are of a large size they produce symptoms which are common to any other large tumor likely situated. Infrequently there are edema and varicosities of the lower extremities. Bladder symptoms may be annoying due to pressure on the viscus. As the tumor gradually enlarges upward disturbances or respiration are complained of—they may grow to such an extent as to cause pressure on the bile duct resulting in jaundice. There is loss of weight and cachexia especially if the cyst be of a malignant nature. More frequent than otherwise the symptoms are vague and the signs indefinite.

#### DIAGNOSIS

A correct pre-operative diagnosis of a retroperitoneal cyst is difficult to make especially if the tumor is found in an adult with a child one suspects a cyst more often in this location than in an older person. They are repeatedly diagnosed as (1) ovarian cysts (2) hydronephrosis (3) tuberculous peritonitis (4) tumors of the kidney is sarcoma or polycystic kidney. The abdominal swelling may be symmetrical or asymmetrical. Especially in

those cysts lying in the loin is a pyelogram helpful. When small the cyst is movable but as its wall gradually becomes adherent to the under surface of the posterior peritoneum it is not movable—not even does it move with respiration. The majority are diagnosed in the course of an exploratory celiotomy for vague abdominal symptoms with enlargement or by the pathologist. To prove their origin it is necessary to enucleate completely the stalk appendix with the cyst attachments and to have microscopic studies made not only of the cyst wall its lining and its entire structure but also of the structure from which the cyst arises. It is well to note carefully and analyze chemically the contents for often it is from the contents alone that a correct diagnosis can be made.

#### TREATMENT

The treatment of retroperitoneal cysts is simple. It entails no complicated procedures. Usually enucleation or marsupialization either in one or two stages (seldom more) is all that is necessary. Those of developmental origin are easily enucleated. An incision should be used which gains easy and comfortable access to the cyst. The approach through the loin gives good exposure to many. Infected dermoids or parasitic cysts give the most trouble in treating as drainage must be established and continued for some weeks. An enucleation in one stage is the procedure of choice. However in children when the cyst is large and the condition of the patient none too good it is wise to empty and remove cyst wall in two stages or to marsupialize. Primrose (12) has presented a method to marsupialize with the least possible or no soiling by suturing an opening in the posterior parietal peritoneum to an opening in the anterior parietal peritoneum. The cyst wall proper is then attacked and is dealt with entirely outside the peri-

toneal cavity. The cyst lies at the bottom of the wound and can easily be opened and drained especially is this method applicable to infected cysts or to those which rise retroperitoneally from the pancreas.

#### SUMMARY

1 These cysts are rare and each case should be reported special attention being paid to the origin.

Detailed macroscopic and microscopic descriptions of the pedicles or of the tissue in close proximity to its origin should be noted as well as chemical and microscopical study of the contents.

3 The most interesting of these cysts originate in vestigial remains of the developing urogenital tract or in the lymphatic systems. Those lined with epithelium come from the former and those without a lining membrane from the latter.

4 The diagnosis is difficult and symptomatology of but scant help.

5 Treatment is simple: enucleation in one or two stages according to size of tumor and condition of patient or marsupialization.

6 Prognosis is good. There is seldom a recurrence.

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# OSTEITIS FIBROSA AND THE HYPEROSTOTIC FORM OF BONE SYPHILIS<sup>1</sup>

A COMPARATIVE ANATOMICAL AND ROENTGENOLOGICAL STUDY

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CONSIDERABLE difficulty and confusion still exists in the gross anatomical and roentgenological differentiation between the hyperostotic form of bone syphilis and osteitis fibrosa. Briefly it can be stated that all congenital and acquired syphilitic changes of the skeletal system are the result of two fundamental processes going on simultaneously: first the destruction of bone substance by syphilitic granulation tissue and second the new formation of bone. Syphilitic granulation tissue is laid down in a simple inflammatory non specific form or as circumscribed gummata. It is thus possible to distinguish between simple and gummatous periosteitis as well as between simple and gummatous osteitis and osteomyelitis. However it is characteristic of syphilis frequently to find these forms in combination. Moreover there are often added the complicating infiltrative and ulcerative processes in the overlying soft parts occurring especially in the superficial bone lesions. There is as well the secondary reactive and reparative formation of new bone around gummata and in the healing of bone defects. It is in the varying combination of these factors of destruction and repair that the great variations are to be noted in the anatomical and roentgenological pictures in bone and joint syphilis.

The primary purpose of the investigation which I have undertaken is an effort to establish the differential diagnosis of the hyperostotic form of bone syphilis from osteitis fibrosa. A further effort will be made to establish a basis for the roentgenological recognition of these two diseases upon the anatomical and pathological characteristics of the affected bones. As will be seen the subject of bone syphilis is intimately joined with that of osteitis fibrosa. This study will be largely concerned with the anatomical and roentgenological differentiation of these two diseases.

Hahn and Deycke (11) in 1907 were the first to systematize clearly the manifold roentgen pictures of delayed congenital and acquired syphilis and to describe the roentgen diagnostic characteristics of the individual forms. Anatomically and roentgenologically, the purely osteoplastic bone lesions form a particular and characteristic group. They occur either as circumscribed tophi, or as diffuse hyperostoses of the long bones. The latter is the clinically important form. It is less common than the gummatous form and may occur both in delayed congenital and in acquired syphilis. Its sites of predilection are the tibia and the bones of the forearm as generally in bone lues though other long bones may also be affected. In contrast to the gummatous form the soft parts are not involved in the diffuse hyperostotic type of bone syphilis.

The first particular clinical and roentgenological study of the diffuse hyperostotic form of syphilis was made by Axhausen (1) in 1913. The change in the external appearance of the bones is remarkable. They become plump, irregularly thickened and deformed. At times even monstrosities result. Sometimes they are sclerotic and heavy and in other cases lighter and more porotic. The outer surface of these bones is usually rough, often being covered with fine and coarser jagged stalactite like processes. Adjacent bones such as tibia and fibula or radius and ulna may be synostotically joined. When sawed through in the long axis the cross section of the bone shows a fundamental change in the internal architecture. The normal boundary line between the compacta and marrow cavity is gone. The original compacta has disappeared and has been replaced by dense sclerotic, enlaved like bone or by a finely porous bony structure resembling pumice stone. The former marrow cavity is filled by continuity by a similar bony struc-

ture. This osteoplastic inflammation begins in the bone cortex as an osteitis or in a narrower sense it originates in the marrow cavity as an osteomyelitis (compare Hahn and Deycke 11). Practically in all cases the periosteum also is involved in the process.

As pointed out by Axhausen (1) necroses of the original bone and also of the newly formed bone play an essential role in the often excessive formation of new bone. As is the case with all bone necroses they exert a powerful stimulus upon the osteogenetic tissues, i.e. the periosteum, endosteum and connective tissue. The necrotic areas become surrounded and infiltrated by proliferating bone building tissue. In this manner the newly formed bone structure finally completely replaces the preformed dead bone. A rarefying osteitis may occur in an originally sclerotic area leading in such a case to a secondary osteoporosis. On the other hand the originally looser newly formed spongy bone in healing may become sclerotic.

Corresponding to these anatomical changes the normal line of demarcation between the corticalis and the marrow cavity can no longer be seen on the roentgen picture. Instead the more or less irregularly thickened bone casts a diffuse dense broad or a lighter spongy shadow. It is often mottled by irregularly outlined denser dark spots. Enclosed in this diffuse shadow one can often recognize rests of the original corticalis band shadow. These represent the remains of the original compacta which have not as yet been rebuilt. The periosteum is so intimately involved in the process that as Hahn and Deycke emphasize it can be recognized only with difficulty here and there. These authors also state that the marked widening of the bone is not essentially due to periosteal bone deposition but that for the most part it is the result of purely osteitic processes. Furthermore they have described a peculiar and characteristic structure of the thickened bone mass. Not uncommonly the roentgen picture shows dark and light striping directed lengthwise parallel to the corticalis giving the impression of a regular arrangement. They believe that these striped areas are due to exudate in the haversian canals and that they are distributed in a

very characteristic manner according to the degree of the general bone involvement. This roentgenological structure as described by Hahn and Deycke has been shown to be correct (compare our findings). However it has nothing to do with the haversian canals or haversian spaces, i.e. haversian canals pathologically widened by syphilitic granulation tissue nor with any preformed spaces. On the contrary this peculiar shadow network corresponds to the axially directed meshes of the completely new formed spongiosa which has replaced the original bone. It contains longitudinally directed somewhat irregular small hollow spaces but no haversian canals. These have disappeared with the destruction of the old compacta.

Osteitis and osteomyelitis simplex diffusa osteoplastica give a characteristic diagnostic roentgen picture according to Hahn and Deycke. Pictures of this kind (compare Plate XI Figs 14, 15, 16) are seen in no other disease except lues. Axhausen (1) thinks that it is not difficult to recognize them as syphilitic but that this can be done only when the periosteal surface shows the characteristic roughenings and serrations. If on the other hand the periosteal surface is smooth these roentgen pictures can hardly be distinguished from those of osteitis fibrosa. Three such cases involving the radius, humerus and clavicles with corresponding roentgenograms are reported by Axhausen. In Case 2 of syphilitic osteoplastic osteitis and osteomyelitis humeri in an 18 year old girl the roentgen picture shows exclusive of an almost unchanged lowermost portion a uniform diffuse bone shadow surrounded by a thin corticalis. This picture (and particularly such pictures of the tibia) according to Axhausen could hardly be distinguished from osteitis fibrosa. A differential diagnosis of the two diseases on the basis of such roentgenograms would be impossible.

For practical differential diagnosis we have additional diagnostic aids at our disposal such as the anamnesis, clinical findings, the Wassermann reaction, the therapeutic test and the surgical removal of a specimen for histological study. However the anamnesis and clinical observations may lead us astray.

and failure to improve under antiluetic treatment does not of course rule out syphilis. A case of osteitis fibrosa may have a coincident positive Wassermann or despite lues a negative Wassermann may be present. However since the histological pictures of the two diseases are radically different the surgical removal of a specimen for microscopic study taken from a proper place would make the diagnosis. Nevertheless this is a rather heroic measure.

In all events there seem to be at least gross morphological similarities between the clinical pictures of hyperostotic bone lues and osteitis fibrosa (von Recklinghausen 23). The latter is identical with or includes osteitis deformans of Paget (18-19) osteodystrophia deformans of Mikulicz (17) or E. Rehn (25) and osteodystrophia fibrosa of Stenholm (30). The false interpretation of purely morphological resemblances has led to considerable confusion in this field. Hutchinson (12) already had spoken of an osteitis deformans in cases of syphilis. In 1885 Silcock (27) pointed out the illusory similarity of the bone changes in delayed congenital lues particularly in the tibia to those of osteitis deformans (Paget). Werther (31) in 1891 reported a case of a 16 year old boy with deforming osteitis of both tibiae and the right femur on a hereditary syphilitic basis. Lannelongue (15) in the Académie de Médecine in Paris (1903) attempted to prove that luetic bone changes which occurred in childhood and adolescence were analogous and even identical with those seen in Paget's disease in middle and advanced age. According to him osteitis deformans (in the sense of Paget) is a *syphilis osseuse héréditaire tardive* which has taken on the special characteristics of the age at which the individual is affected. Thus he considers Morbus Paget as the *type des adultes et des vieillards* in contradistinction to the puerile adolescent type *chez les enfants et les adolescents*. Frechon (9) Menétrier and Gauchler (16) and others among these Fournier (6-7) support Lannelongue's contention. Fournier considers Paget's disease as a parasymphilitic affection. The influence of this theory is still seen though somewhat attenuated in the work of Skullern (28) in 1913 who on the basis

of a positive Wassermann in a single unproven case considers that at least some cases of osteitis fibrosa (osteomyelitis fibrosa solida Bloodgood 3) are identical with delayed congenital bone syphilis. As we have already indicated this conception of osteitis deformans is based mainly upon the similarity of the external gross morphological changes in the affected bones and extremities.

In Paget's disease the bones are plump or regularly thickened and deformed. Because of their rebuilding and complete change in architecture the bones may take on very bizarre appearance. As in cases of lues the tibia is frequently affected in osteitis fibrosa it times even being the only bone involved. The elongation and accompanying bowing of the long bones particularly of the tibia observed in syphilis occur likewise in osteitis fibrosa. Fournier (6) as early as 1886 considered the sabre tibia (*en lame de sabre*) pathognomonic for delayed congenital lues. Lannelongue (15) speaks of a tibia *en fourreau de sabre* a sabre scabbard tibia. The tibia is bent on the straight fibula the latter corresponding to the string of a bow. The tibia bows as a result of its elongating without corresponding lengthening of the fibula. However elongation may have occurred even when a perfectly straight tibia is seen (compare for example with Benazet 2 Fig 18 obs 24 in a girl 3 years old and Fig 35 obs 27 in a girl of 6 years). Other bones may become elongated and deformed such as the ulna (Krayn 14 p 11) or the radius (Stadler 29 and our Case 8 see below) in these cases with bilateral sabre tibia also. The pathognomonic significance of the sabre blade or sabre scabbard tibia for congenital lues has been overthrown since Gangolphe (comp Benazet 2 p 109) who cites other authors and Fritsch (10) in 1910 have reported the occurrence of tibia *en lame de sabre* in cases of syphilis in adult life i.e. after the age of growth.

The gross resemblance between the tibia *en lame de sabre* of lues and the sabre tibia of osteitis deformans cannot be denied. But the underlying histological process resulting in the rebuilding and the new form of the bone in osteitis deformans is entirely different from that in diffuse syphilitic osteomyelitis. There

fore it seems inexplicable that Skillern (28) should feel disinclined to excise a specimen for histological study on the ground that 'the microscope would be no better arbiter here than the methods described for when the skiagram shows areas of bone absorption and of bone production we can picture in the microscope of our minds the busy osteoclasts demolishing and osteoblasts constructing respectively

In syphilitic osteomyelitis simplex diffusa osteoplastica the marrow in the interstices of the spongiosa and the haversian canals is converted into syphilitic granulation tissue. The original bone is resorbed by giant cells (osteoclasts) while osteoblasts build new reticulated (*geflechtartig*) bone which fills in the widened spaces. This new bone again may be destroyed and replaced by new reticulated bone. Portions of the bone may become necrotic and thus act as a special stimulus to the formation of new bone (compare above). In this manner the preformed bone structure disappears and sclerotic or more porotic hyperostotic long bones are formed.

In Paget's disease (osteitis fibrosa) on the other hand the lymphoid or fat marrow is converted into fibrous connective tissue. The old bone is destroyed by an enormous number of giant cells. Necroses play no appreciable part in this disease process. The newly formed bone built for the greatest part by osteoblasts persists as osteoid. The latter is found in large amounts in osteitis fibrosa or deformans. For this reason the consistency of the bone as a whole is soft in this stage of the rebuilding process. Von Recklinghausen (24) gave the name metaplastic malacia to the process. According to the quantitative relation between the production and absorption of bone there result not only hyperostotic but also hypostotic pseudomalacic forms (observed by L. Pick 20 in 1919 and E. Christeller 4, 5 in 1920 and 1923). The hyperostotic form may be either hyperostotic porotic or hyperostotic sclerotic. Up till now no human cases of the latter have been reported but its existence has been proved conclusively in simians. On the basis of a most thorough examination of L. Pick's material (12 cases the majority with complete autopsy

including skeletal system) Ture Stenholm (30) in 1924 has classified the individual forms of osteitis fibrosa or as named by him osteodystrophia fibrosa. In this classification Paget's disease is the generalized hyperostotic porotic form of old age a subdivision of osteodystrophia fibrosa.

The absolute genetic difference must be clearly recognized between the hyperostotic form of syphilis and osteitis fibrosa despite their apparent resemblances and gross external similarities. To a degree there also are differences in the mode of elongation and deformity of the long bones in the two diseases. In delayed congenital lues the elongation of the diaphysis is the result of stimulation of the epiphyses by the syphilitic osteoperiosteitis (Wieting 32) being analogous to the increase in length of the shaft in other bone diseases which occur during the period of growth. The bone is still soft and may be involved by a rarifying osteitis. The pliability of the bone may persist until the subsequent formation of new sclerotic bone by the periosteum. Under certain conditions the sclerotic new bone may again be replaced by a more porotic bone (compare Stadler 29). The fibula not being similarly stimulated does not elongate or at least does not elongate as much as the tibia. Therefore the lengthened tibia of necessity must bow. Since the radius or ulna also may elongate and bow we can readily see how unimportant a factor mechanical weight bearing is in the production of the deformities.

Since osteitis fibrosa occurs mostly in the later years of life after cessation of epiphyseal growth the process resulting in elongation must be different from that in delayed congenital lues. In osteitis fibrosa the lengthening is due to the complete rebuilding of the bone proper. There is excess new formation of bone in length as well as in width and thickness.

In cases of hyperostotic syphilitic osteomyelitis where lues has been acquired after the growing period the processes causing the elongation must also be of a different nature than in the congenital form. In these cases there may be a complete rebuilding of the diaphysis with destruction of the original bone structure. The lengthening results from mas-



sive new bone formation. In these particular cases the process is genetically the same as in osteitis fibrosa. Since stimulation of the epiphyses in congenital lues may be caused by a primary simple osteomyelitis as well as by a primary gummatous osteitis and osteomyelitis or by a periosteitis near the epiphysis we can easily understand why the elongation and bowing of the long bones especially of the tibia should be considered by some (Kaufmann E 13) an accompanying manifestation of gummatous osteitis or of gummatous periosteitis (Hahn and Deycke 11 Plate 2 Figs 11 and 12), or by others (Axhousen 1) as an expression of diffuse bone lues. The fibula remains straight stretched as the string to the bow even when it is also involved in the syphilitic hyperostotic osteopenostotic process (see Stadler 29 Hahn and Deycke 11 Plate 2 Fig 11 and in our material). The tibia is so much more intensely affected than the fibula that the elongation of the former is greater than that of the latter. Therefore despite the lengthening of the fibula the tibia nevertheless is bowed.

In the light of these findings we cannot deny gross morphological resemblances particularly in the elongation and deformity of the long bones between deforming osteitis fibrosa and hyperostotic syphilis. However in contrast to Lannelongue and Fournier we would not use this mere gross morphologic similarity as evidence to prove the identity of osteitis fibrosa (Paget's disease) with hyperostotic lues nor to declare that delayed congenital lues is the pueradolescent form of Paget's disease.

In addition to Paget's disease (the hyperostotic porotic senile form of deforming osteitis fibrosa) we must compare the endosteal form of osteitis fibrosa with hyperostotic bone syphilis. It has also been termed the medullary form in contradistinction to the cortical. It apparently represents a juvenile form of osteodystrophia fibrosa (Stenholm 30 Cases 11 and 12) and is a subdivision of the hyperostotic porotic type. In the endosteal form the bone rebuilding process begins at the inner surface of the corticalis however sparing the compacta for the time being. The entire marrow cavity of the diaphysis becomes filled

by a finely spongy porous bone mass. The process extends into the epiphyses by continuity or in circumscribed isolated areas. Such foci also occur in the short cancellous bones. Despite these marked internal changes there is no alteration in the outer form of the bone in the earlier stages of the disease. On fresh cross section the whole diaphysis is filled up by a whitish yellow mass resembling marzipan (L. Pick 21). Only in a more advanced stage does the process extend into the bone parts of which may be completely replaced. There may be flattened hump-like elevations of the compacta causing deformity of the bone. The surface over the elevations is finely porous. Otherwise the surface is smooth.

Thus we have fundamentally divided osteitis fibrosa particularly the hyperostotic porotic senile form (i.e. Paget's disease) and the endosteal juvenile form from hyperostotic bone syphilis. The question now arises to what extent does the external morphological similarity of the bone changes in these two diseases manifest itself in their roentgenological relations? In other words is it possible to make a differential diagnosis between these two diseases by means of the roentgen picture alone?

At the suggestion and with the helpful cooperation of my teacher Prof. Dr. Ludwig Pick I have examined his large collection of pathological bone material in an effort to throw some light upon this question. In this work I have utilized the method of X raying the macerated bones (Eugen Fraenkel 8 and L. Pick 22) and with this means have been able to obtain interesting and important information.

The following are three cases of osteodystrophia fibrosa with the anatomicopathological descriptions and roentgen findings. Two are cases of the hyperostotic porotic senile form with sabre tibia i.e. Paget's disease and the other consists of the bones of the leg of a case of osteodystrophia juvenilis (L. Pick 21) i.e. the endosteal type. A complete description of these three cases with full microscopic examination is found in Stenholm's work.

CASE 1 (Stenholm's Case 2) A very small man age 79 years with Paget's disease (the hyperostotic porotic senile form of osteodystrophia fibrosa). The



Fig 1

Fig 1 Photographs of sagittal section of the tibial shaft from (from right to left) Case 3 and hyperostotic porosis fibrosa (left) and Case 3 and hyperostotic porosis fibrosa (right).



Fig 2

Fig 2 Photographs of the tibia and fibula of Case 3. The tibia is on the left and the fibula is on the right.



Fig 3

Fig 3 Roentgenogram of the tibia and fibula of Case 3. The tibia is on the left and the fibula is on the right.

left tibia was sawed through lengthwise and the macerated medial half (Fig 1) is shown. The bone is 33 centimeters long from medial condyle to internal malleolus. The tibia is sabre shaped and bowed with the convexity anteriorly. Its proximal two-thirds is markedly widened while the distal half is practically unchanged. The maximum breadth of the upper portion of the shaft is 5.4 centimeters. The average breadth at the distal part of the shaft is 4 centimeters. Distally the cortical and marrow cavity are normal. More proximally the rind becomes thickened and is very markedly split up into longitudinal lamellae and shaft. The thickening is greatest anteriorly reaching a thickness up to 2 centimeters. Here and there in the porous bone mass comprising the rind are some what larger cavities and perforations. The greatly widened marrow cavity is lined and partly filled by a dense network of porous bone. At the distal end of the bone the spongiosa appears normal. The proximal part of the outer surface is flat, uneven and rough being studded with

bony protuberances or many closely spaced pores. The proximal part is divided from the normal distal portion of the outer surface by an elevated area running obliquely forward and down. The tuberosity of the tibia is enlarged upward to the size of a large dove's egg. In the most proximal preparation (the lateral half of the tibia) the meshes of the spongiosa in the marrow cavity contain yellow fat marrow.

The left fibula shows no gross pathological changes. In the roentgenogram of the left tibia medial half only the lower epiphysis shows a normal structure (Fig 3). The lower one-third of the corticalis shows fine longitudinally directed lamellation. More proximally this splitting up of the rind reaches a very high degree. The structure here is very loose so that between the dark shadows there are large areas which are wholly permeable to light. Corresponding to the enormous thickening of the proximal part of the bone the marrow cavity is much broader here. The marrow cavity is



Fig 4



Fig 5

Fig 4 R tibia f Case hyperostotic  
 Fig 5 Roentgenogram of the right tibia f Case hyperostotic  
 Fig 6 Roentgenogram of the right tibia f Case hyperostotic



Fig 6



Fig 7

Fig 6 Roentgenogram of the right tibia f Case hyperostotic  
 Fig 7 Roentgenogram of the right tibia f Case hyperostotic

tra er el and surru f l by m s trabeculae and only in a few circumscribed areas the pongiosa thickened. It is particularly to be noted that the outer surface is perfectly smooth in its entire extent.

The left fibula shows no noteworthy changes except that in a few places the cortical thickness is a little shows longitudinal lamellations.

CASE 2 (Stenholm's Case 7) A very large man age 74 years with Paget's disease (hyperostotic porotic senile form of osteodystrophia fibrosa). The right tibia as seen through lengthwise macerated medial half (Fig 1). The bone was 44 centimeters long from medial condyle to medial malleolus. It is markedly bowed anteriorly and is sabre-shaped. The cortical is wider posteriorly than anteriorly (2.4 centimeters against 0.5 centimeters) and everywhere shows small longitudinal fissures and pits running parallel to the outer surface. The marrow cavity is tremendously distended and extends far into the epiphysis. It is everywhere lined with a porous trabecular spongiosa which in some places

also bridges across the marrow cavity. The outer surface is roughened in practically its entire extent with many hump-like small flat protuberances. In a rather large area 4 centimeters below the medial condyle it is especially rough and in the upper part of this area is perforated by many closely adjacent little holes. The largest of these have a diameter of about 0.8 centimeter. The bone round below has a sponge-like coarsely porous structure in its entire thickness. In the moistly preserved preparation the lateral half of the right tibia the marrow cavity is filled with fat marrow.

The right fibula is relatively normal. The roentgenogram of the medial half of the right tibia (Fig 4) shows a complete rebuilding of the entire bone except for the lower epiphysis. The anterior and posterior corticalis cast a fairly dense shadow with finely lamellated lightened markings and more irregular pores. These markings in general are parallel to the long axis of the bone. At the point of the greatest convexity anteriorly the shadow

has a blunted appearance. A similar prominent outgrowth is found on the posterior surface in its upper one third. Nowhere is there a shadow of periosteal thickening. The numerous larger and smaller illuminated areas often fairly well circumscribed represent fat masses as were seen in the mostly preserved specimen.

CASE 3 (Stenholm's Case 9 Fig. 3). A 15 year old boy with the juvenile endosteal form (L. Pick) of osteodystrophia fibrosa. The right tibia was saved through lengthwise anterior half macerated. The bone was 36 centimeters long from medial condyle to internal malleolus, width mid portion 2.4 centimeters. The bone is lengthened but there is no bowing. On the external surface there are three flat elevations which together take in the entire length of the shaft. On the middle elevation the medial part of the surface is porous but the rest is smooth and unchanged. The middle portion of the marrow cavity is evenly filled by a very fine spongy bone mass. It also extends proximally and distally but here it leaves the most central portion of the marrow cavity unchanged. Several isolated circumscribed foci about the size of a hazelnut composed of this dense spongy bone mass are found in the proximal epiphysis. The corticalis for the most part is fairly thin not exceeding 0.4 centimeter in thickness. It is especially thin in the upper lateral portion and in the area at which the surface is porous the corticalis is completely gone.

The right fibula was saved through lengthwise medial half macerated. It measured 33 centimeters long. The bone is diffusely widened except for the most proximal segment. It is 1.9 centimeters broad in the mid portion. The entire marrow cavity except at the epiphyses is filled up by a finely spongy bony network which is coarser than that seen in the tibia. There is a focus of similar structure about the size of a bean in the spongiosa of the distal epiphysis. The corticalis has a maximal thickness of 0.3 centimeter but is mostly very thin, often being as thin as paper. The outer surface is finely porous here and there otherwise the remainder is smooth and unchanged.

In the mostly preserved half of the tibia the spongy bony ingrowth into the interior of the bone is represented by a uniform yellowish white mass resembling marzipan.

The roentgenogram (Fig. 5) shows the right tibia anterior half and the right fibula medial half. The tibia is much less permeable to light than the fibula. The fibula shows a diffuse central shadow with very fine markings and lighter areas. Portions of the corticalis are replaced by this shadow. The remainder is dense and thin. The tibia shows coarser bone trabeculae and also more solid masses. Its corticalis is thin and in places is entirely gone, merging into the diffuse solid shadow. Isolated dense foci are seen at the proximal end of the tibia and at the distal epiphysis of the fibula. The proximal and distal epiphyses of both bones and a small part of the tibial diaphysis adjacent to the distal epiphysis



Fig. 8 (above) Roentgenogram of tibia of Case 6 syphilis. Below: Roentgenogram of tibia and fibula of Case 7 syphilis.

(metaphysis) cast a relatively normal shadow. The remaining portions of both bones are completely rebuilt. Despite this tremendous change in the architecture of the bones their outer surfaces are perfectly smooth. There is no periosteal shadow at any place.

The chief characteristic of the anatomical and roentgenological findings in these cases is the complete absence of any periosteal participation. Even though the outer surface of the bone is uneven, parts being covered with flattened elevations and protuberances (as in the first case of Paget's disease) the roentgen picture (Fig. 3) nevertheless shows that these outgrowths doubtlessly are purely cortical in nature. In the third case the juvenile form the periosteum is also entirely uninvolved despite the enormous endosteal formation of bone which has filled up the marrow cavity and has partly replaced the corticalis up to the periosteum, even causing a hump-like elevation of the latter.

The second important feature is the state of the marrow cavity. In the first two cases (as seen in the photographs of the cross sections of both the tibiae Fig. 1 and especially in their roentgen pictures Figs. 3 and 4) the marrow cavity is markedly widened and particularly in the second case so roomy that it extends far into the epiphyses. Even when a portion of the marrow cavity is partly filled up by a newly formed dense spongiosa it contains only yellow marrow as demonstrated in the mostly preserved half of the bones. In the endosteal form the marrow cavity is diffusely filled by the characteristic marzipan-like mass. It is very important to note that this marzipan-like bone may form in still un-

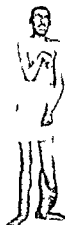


Fig. 1



Fig. 11



Fig. 12



Fig. 13

Fig. 10. Photograph of Case 8, syphilis.  
Fig. 11. Roentgenogram of right tibia and fibula.  
Fig. 12. Roentgenogram of right tibia and fibula.  
Fig. 13. Roentgenogram of right tibia and fibula.

Fig. 14. Roentgenogram of right tibia and fibula.  
Fig. 15. Roentgenogram of right tibia and fibula.  
Fig. 16. Roentgenogram of right tibia and fibula.  
Fig. 17. Roentgenogram of right tibia and fibula.

involved area of the pelvis a circumscribed isolated focus up to the size of a hazelnut also in flat cancellous bones such as the vertebra. Such foci may be seen in our case in the proximal epiphysis of the right tibia or in the distal extremity of the right fibula. They are excellently shown in the roentgen pictures.

The third important point is the appearance of the rebuilt bone substance. In the endosteal type of osteitis fibrosa (Case 3) it is finely spongy and densely porous, being of greater density in the tibia than in the fibula. A different condition is found in the two cases of senile osteitis fibrosa with sabre tibia (Paget's disease). In Case 2 the rebuilt corticalis in general is compact though it is traversed by numerous fissures and cracks arranged parallel to the outer surface. In Case 1 the corticalis is split up into larger lamellae which also run parallel to the outer

surface. The lamellations have a very characteristic appearance in the roentgenogram. The finely porous character of the outer surface may be accentuated to form larger coarser perforations as in Case 3. These as readily seen are purely osteitic in nature and have nothing to do with any perosteal involvement.

For comparison with the anatomical and roentgenological pictures of osteitis fibrosa we are presenting the following four syphilitic tibiae, some also with the fibula. Three of the preparations have been macerated and the fourth mostly preserved. The syphilitic nature of the bone change in these specimens has been proved by the other autopsy findings except in Case 7 in which the bone alone was removed for examination.

CASE 4. Collection No. 1009/207. A homemaker, age 59 years, who was homeless, had slept outdoors on a cold December night. He was almost frozen

when admitted to the hospital and died with signs of pneumonia. At autopsy (No. 1009/1215 Prof. Dr. L. Pick) the following was found: (1) obliteration of both pleural cavities (2) widespread tuberculous bronchopneumonia of both lungs with many areas of purulent softening in the right upper lobe (3) purulent tracheitis and bronchitis (4) numerous tuberculous ulcers in the large intestine (5) amyloidosis of the liver, spleen and kidneys (6) pyptic ulcers in the duodenum (7) mesenteritis syphilitica (8) fibrous orchitis (9) right tibia on palpation was greatly thickened and the surface irregular. There were widespread varices on the left leg. Both tibiae and fibulae were removed and macerated.

The right tibia was saved through in sagittal plane. It measured in length 38 centimeters in width 5.5 centimeters in thickness (A-P) up to 5 centimeters. It weighed 500 grams.

The right tibia is greatly thickened in its entire length and is very heavy. A small portion of the outer surface is smooth. The greater part especially on the lateral aspects is rough being covered by many sharp edged scales, spicules and dentate projections. These are often confluent forming bony bridges and ridges. In a few areas the surface has a dense porous appearance. On cross section both ends of the bone are normal in structure. The diaphysis is composed of a dense spongy central portion and a broad very compact cortical sheath. The latter are about 1.5 centimeters wide and are more or less eburnated with solitary finely porous areas. There is no actual marrow cavity. In the proximal portion of the diaphysis the central spongy bone is so dense that it is continuous with and practically indistinguishable from the cortical. The thick anterior cortical sheath begins 3 centimeters below the distal epiphysis. Below this it merges into normal cortical.

The right fibula was saved through in sagittal plane. It measured in length 37.5 centimeters in width 2.3 centimeter and weighed 55 gram. In its proximal three fourths the right fibula shows changes similar in degree and character to those seen in the right tibia. The distal one fourth is normal both externally and on cross section. The proximal three fourths of the outer surface is very rough with many scale ridges and dentate processes. On cross section the proximal epiphysis is composed of spongy bone. The rest of the pathologically altered diaphysis shows the same changes (corticalis and central spongiosa) as seen in the tibia. In the distal part of the distal diaphysis the three zones become qualitatively distinct and indistinguishable from one another.

The left tibia was saved through in sagittal plane. It measured in length 38 centimeters in width 2.3 centimeter (maximal height 1 ft) thickness (anterior-posterior) 1.4 centimeters (maximal) and weighed 240 grams. The left tibia markedly flattened from side to side and is only slightly heavier than normal. The surface of the tibia is smooth. On cross section there is slight thickening of the post-

erior corticalis. The anterior corticalis is markedly thickened (up to 1.5 centimeters). The maximal thickening is about 12 centimeters distal to the proximal epiphysis and causes a pseudo bowing of the tibia anteriorly. At this point the anterior surface is slightly roughened over an area 4.5 centimeters in diameter.

Left fibula weighed 48.5 grams was 38 centimeters long and showed no pathological changes (Fig. 6).

On the roentgenogram the upper and lower epiphyses of right tibia show no changes. The marrow cavity is filled by a fairly dense porous mass casting alternating dark and light shadows. The original corticalis shadows can be recognized as a central shaft enveloped by an enormous periosteal thickening. The latter reaches a thickness of 25 millimeters. Its border is very irregular with many indentations and comb like projections. The periosteal shadow is for the most part quite dense but here and there is maculated by light and dark areas. The fine pores are often directed lengthwise parallel to the shaft. The corticalis can be distinguished from the periosteum and marrow cavity by the greater density of its shadow but gradually it merges into them. The most distal part of the bone for a distance of 4 centimeters is free from periosteal deposit.

Case 5. Collection No. 1910/130 (Autopsy No. 1910/861 by Prof. Dr. L. Pick). Patient was a laborer aged 22. The important findings at autopsy were: fibrinous pneumonia of entire right lung and left lower lobe; recurrent verrucous mitral endocarditis; fresh fibrinous pleuritis of right lower lobe; parenchymatous degeneration of heart muscle; both tibiae were diffusely thickened and somewhat bowed anteriorly; a sharp edge could not be felt anteriorly. Bones of both legs were removed and macerated. The right tibia was preserved *in toto*. It measured in length 36 centimeters in breadth (right to left) 4.3 centimeters in thickness (anteroposterior) 4.3 centimeters.

Only the epiphyses and the lower shaft end appear relatively normal. The remaining portion of the bone is markedly and somewhat unequally thickened. The greatest part of the outer surface is covered by many fine and coarse lacunae and larger furrows. These furrows are directed parallel to the long axis of the bone.

The right fibula was preserved *in toto*. It measured in length 35 centimeters. There are no pathological changes except for two small rough areas on the outer surface of the distal part of the shaft.

The left tibia was saved through in sagittal plane. It measured in length 38 centimeters in breadth (right to left) 4.4 centimeters in thickness (anteroposterior) 4.5 centimeters. The appearance of the outer surface is similar to that of the right tibia. Especially to be noted is that the direction of the grooves and furrows is lengthwise parallel to the long axis of the bone. A portion of the outer surface about 6 centimeters long at the proximal end of the diaphysis is smooth and shows no changes. Cross section shows the marrow cavity

preserved except for an area 7 centimeters long at the junction of the middle and lower third of the tibia where the marrow cavity is filled by a closely meshed spongiosa. The anterior corticalis is thickened 22 millimeters. The maximal thickening is at about the middle of the bone and causes a slight anterior bowing. The posterior corticalis is thickened though less than the anterior up to 17 millimeters. The maximal thickness corresponds to the point at which the entire marrow cavity is filled by spongiosa. The spongiosa here gradually merges into the corticalis and cannot be distinguished from it. In the upper one third of the diaphysis the posterior corticalis is relatively normal. The anterior and posterior corticalis are compact showing in places fine and coarser pores. Any further distinction of the bone sheaths cannot be made grossly. The epiphyses are normal.

The left fibula was preserved *in toto*. It was 36 centimeters long. Chiefly the lower half is thickened. Especially in this area is the outer surface roughened with many depressions and furrows having an appearance similar to that of the tibia. Likewise the direction of the furrows is parallel to the long axis. The epiphyses are free from change.

The roentgenogram (Fig. 7) shows the right tibia and lateral half of left tibia. The marrow cavity of right tibia in the greater portion of the diaphysis has almost entirely disappeared. The bone shadow in parts is very dense. At other places there are many lightened areas representing the furrows which are directed longitudinally parallel to the long axis of the bone. At the proximal end posteriorly the corticalis is easily recognized. It is also well seen at the distal end anteriorly and to a lesser degree posteriorly. Anterior to the corticalis which is composed of fairly firm bone there is a wide shadow more porous in structure which is due to periosteal deposition. Posteriorly there is a similar but lesser periosteal thickening. Toward the central portion of the bone the corticalis shadows gradually merge with the shadows of periosteal thickening and of the obliterated marrow cavity so that they can hardly be distinguished from each other. The epiphyses are normal.

The picture of left tibia shows that the bony thickening is chiefly periosteal. The corticalis especially posteriorly is sharply defined from the periosteal thickening in almost its entire length. This can also be seen anteriorly except in the central portion where the marrow cavity is filled up by the spongiosa. The periosteal thickening anteriorly is more coarsely porous than posteriorly. In the latter parallel lamellated markings are clearly seen. In the middle portion of the bone where the marrow cavity is obliterated the anterior and posterior corticalis and to a slight extent the posterior splits up and merges into the generally porous bony structure.

The lateral side of the left fibula shows extensive similar changes. In the distal half of the diaphysis the corticalis has a lamellated appearance the marking being directed lengthwise. The periosteal deposit (5 millimeters thick) is sharply defined from the

corticalis by a dark line. Such a sharp line of demarcation cannot be seen in the proximal half. Here there is marked generalized thickening of the corticalis with fairly distinct longitudinal lamellations running parallel to the long axis of the bone.

CASE 6. A laborer age 29 years with the diagnosis of pneumonia and liver trouble. At autopsy (Prof. Dr. von Hansemann No. 1875/178) the following was found: (1) lungs showed tuberculous bronchopneumonia in left upper lobe with milary tubercles on the left pleura. Fresh bronchopneumonic areas in both lungs. Syphilitic scars (interstitial pneumonia) left lower lobe (2) fatty liver (3) left kidney pea sized gumma in cortex (4) tongue was smooth with syphilitic scars (5) right tibia was bowed anteriorly and on palpation was greatly thickened with rough protuberances. The tibia was removed. It was very heavy.

The right tibia (Specimen No. 1895/75) was mostly preserved and sawed through in sagittal plane. It measured in length 38 centimeters in width (right to left) 3.5 centimeters (maximal) in thickness (anterior posterior) 5.5 centimeters (maximal). The right tibia is moderately bowed with the convexity anterior. There is marked lateral flattening (sabre form). The outer surface is smooth except for small areas where there are fine pointed and flattened excrescences. On cross section the posterior corticalis is compact except for small localized porous areas in which the bone is slightly split up. The posterior corticalis is thickened up to 1 centimeter.

The anterior corticalis is recognizable as such only in the distal end of the tibia. Above it merges into a very dense spongy bone structure. This dense spongiosa extends upward and with the exception of small areas obliterates the entire marrow cavity.

Anterior to this and corresponding to the convexity of the tibia there is an eburnated new corticalis sheath extending almost the entire length of the bone apparently built from the periosteum. Its maximal thickness is 13 millimeters. The epiphyses are free.

On the roentgenogram the upper and lower epiphyses of right tibia appear normal (Fig. 8). No marrow cavity can be seen but instead there is a shadow of dense spongiosa. In the proximal half the markings of the meshes of the spongiosa are directed lengthwise parallel to the long axis of the bone. The original corticalis is preserved with normal appearance only in the distal one fourth of the bone anteriorly and posteriorly and in the proximal extremity posteriorly. The remainder of the corticalis is split up into dense longitudinal lamellae. The shadow of the original tibia is so clearly seen in the roentgenogram that one can easily recognize that the thickening of the bone is chiefly due to periosteal deposition. Anteriorly the maximal periosteal thickening is 3 millimeters posteriorly over 5 millimeters. Most anteriorly the periosteal deposit casts a very dense shadow over centimeter broad. Behind the tibia comes more porous gradually merging into the similarly constructed anterior corticalis. The pos-

terior periosteal shadow also varies in density. In the upper one third a coarsely porous cockscomb like protuberance is seen. The marked anterior bowing is almost entirely due to periosteal thickening. The original tibia as seen by its shadow is only very slightly bowed.

CASE 7. Ashoemaker age 31 years died of hæmophysis due to pulmonary tuberculosis. At autopsy by Prof Dr I. Pick the following was noted. Both bones were bowed markedly with the convexity anteriorly. The bones of both legs were removed and macerated. The right tibia (collection No. 1909/112 Fig. 1) was sawed through in the sagittal plane. Its length was 41 centimeters, width (right to left greatest diameter) 4 centimeters, thickness (anterior-posterior) 5 centimeters, weight 440 grams.

The right tibia is heavier than normal, thickened throughout and markedly bowed with anterior convexity. The lateral aspect of the outer surface in the middle one third is extraordinarily finely porous with moss like rough excrescences and some larger stalactite growths. The remaining surfaces are smoother, especially at the ends of the bone but nowhere are they entirely free from change. On cross section the posterior corticalis is compact and unchanged save in the mid portion of the bone where here and there it has a finely porous structure. The greatest width of the posterior corticalis is 7 millimeters. The anterior corticalis presents an entirely different picture. Only at the distal end is it thin. The remaining corticalis is widened and split up into a fine lamellated structure forming a mesh work. The meshes are flattened and are directed lengthwise.

The marrow cavity is approximately normal in width except that it is partly and at the point of greatest convexity entirely filled by spongiosa. The epiphyses are normal.

The right fibula was sawed through in the frontal plane. Its length was 38.5 centimeters, width (right to left greatest diameter) 2.4 centimeters, weight 140.0 grams. The right fibula is greatly thickened and heavier than normal. The outer surface in its upper two thirds is very rough and uneven with many pointed comb like excrescences. The surface between the latter has a finely porous pumice stone like appearance. Toward the distal end the surface is smooth. On cross section the medial corticalis is compact and only lightly thickened. Its maximal thickness is 4.5 millimeters. The lateral corticalis is also compact but almost uniformly thickened up to about 12 millimeters. Most of the marrow cavity is filled by spongiosa so that only a small part of actual cavity remains. The epiphyses are normal.

The left tibia was sawed through in sagittal plane. Its length was 41 centimeters, width (right to left greatest diameter) 3.7 centimeters, thickness (anterior-posterior) 5 centimeters, weight 427 grams. The left tibia is thicker and heavier than normal and is bowed convex anteriorly though to a lesser degree than the right tibia. The outer surface in general is similar to the right but is less rough. On cross sec-

tion the posterior corticalis is compact being 5 millimeters thick. The greatest part of the anterior corticalis is compact but in a few places it has a lamellated porous structure the long diameter of the meshes being directed parallel to the long axis of the bone. It is about 15 to 17 millimeters thick. The marrow cavity is of normal width. At the point of greatest convexity i.e. the junction of the upper and middle third it is completely filled by spongiosa. The epiphyses are normal.

The left fibula weighs 40 grams, is 37.5 centimeters long and shows no gross changes.

On the roentgenogram the upper and lower epiphyses of right tibia are free (Fig. 9). The posterior corticalis is preserved in general as a fairly uniform dense shadow. The entire remaining area is finely porous with single areas of diffused lightening representing the larger coarser pores. In the lower half there is a very dense narrow shadow at the anterior border.

The anterior border is a little wavy but smooth. At the posterior border in the upper one third there is a fine wart like periosteal shadow. A little below the middle there is a narrow periosteal deposit 6.5 centimeters long. The distal half of right fibula is diffusely thickened. Its shadow is very dense here and there being speckled with lighter areas. Toward the proximal end of the bone the lateral corticalis splits up into a fine spongiosa. It is well demarcated from the more lateral dense periosteal shadow. Just distal to this the corticalis and periosteum merge indistinguishably into a dense shadow. The proximal half of the medial corticalis is unchanged. Its distal portion is merged in the dense shadow of the distal half. Both borders are irregularly serrated. The epiphyses are relatively normal.

In this group of cases the method of X-raying anatomical bone specimens particularly proves its value for with no other method of gross or microscopic examination can we so beautifully demonstrate the marked degree to which the periosteum participates in the deforming new bone building processes.

Whereas Hahn and Deycke (11) emphasize that the bone thickening in diffuse osteoplastic syphilis of the long bones is chiefly of osteitic origin and that only here and there is any periosteal involvement demonstrable our findings in Cases 4, 5, 6 contradict these statements. In every one of our 3 cases (4, 5, 6) the thick periosteal bone mantle (so colossal in Case 4) is well shown by the roentgen pictures. Furthermore they show that the diaphysis of the tibia which is enclosed by this periosteal mantle plays a lesser rôle in the tremendous thickening. In all 3 cases the shadow of the original corticalis is clearly



len and its line of demarcation from the surrounding periosteal bone sheath may be followed with great or at least sufficient distinctness. The marrow cavity in all 4 cases (4, 5, 6, 7) is more or less obliterated being filled by a dense newly formed bone mass. In the latter the axially directed fissures as observed by Hahn and Deycke are very distinctly seen. The compacta except in small areas where it is still originally intact shows similar characteristic markings in the roentgen picture. They also are seen in the shadow of the periosteal thickening in Case 5. In Case 4 the periosteal shadow is much more irregular whereas in Case 6 corresponding to the convex surface of the tibia it is bordered off by a very dense band like shadow in the manner of a new outer compacta. This sabre like bowed tibia (Case 6) coincides with Journer's picture. The bowing is only seeming, for in reality the tibia is straight with an anterior periosteal hyperostosis. This is clearly shown by the roentgen picture (fig. 8). On the other hand Wieting (32) (cited by Stadler 29) has demonstrated the occurrence of real sabre like bowing of the bone. Our Case 7 shows an actual bowing of the tibia and taken in conjunction with Case 6 demonstrates that tibia *en lame de sabre* (Journer 6) occur in two forms: the pseudoform with a straight diaphysis and the real form with a bowed diaphysis.

In the last case of syphilis (7) in which the fibula is also involved by an ossifying osteo periostitis its marrow cavity has totally disappeared in the roentgen picture as in the other case. The entire tibial diaphysis except for a small portion of the posterior compacta is completely replaced by a loose and in parts denser spongy bone structure. The axial direction of the medulla in the newly built spongy is very well marked. In this case it is impossible to divide the purely periosteal from the osteal portion thus corresponding to the state pictured by Hahn and Deycke. Only in the concavity of the tibia in the area where the posterior compacta is still preserved does the roentgen picture show a narrow dense periosteal shadow sharply set off from the compacta.

A careful comparison of the anatomical and roentgenological findings in the long bones

of the hyperostotic form of lues with those of the senile hyperostotic form of osteitis fibrosa (Paget's disease) as well as with the juvenile endosteal form (L. Jick) has brought out these fundamental differences.

1. Usually marked and sometimes tremendous participation of the periosteum in the deforming bone building process in lues as compared to the absolute passivity of the periosteum in osteitis fibrosa.

2. Marked uneven widening of the marrow cavity in Paget's disease compared with more or less complete bony obliteration of the marrow cavity in lues.

3. Lamellar splitting up of the corticalis in certain of the cases of Paget's disease compared with the characteristically axially directed arrangement of the medulla of the newly formed hyperostotic bone in lues. This latter arrangement is also found in certain cases of Paget's disease (Case 2) but in these cases the widened state of the marrow cavity and the absence of any periosteal involvement are diagnostically decisive. Since the periosteum is passive in osteitis fibrosa the pseudoform of tibia *en lame de sabre* of course cannot occur in these cases. Thus we have found typical differences along several lines.

However it cannot be denied that there is great similarity between the anatomical and roentgenological findings in cases of the juvenile endosteal form of osteitis fibrosa (Case 3) and those of hyperostotic bone syphilis in which it is impossible to prove that the periosteum participates in the new bone building process (Case 7). At the present time it is not known whether the sabre form of tibia occurs in the juvenile endosteal form of osteitis fibrosa but of course such a possibility cannot be excluded. In all events in both diseases there is a complete replacement of the original preformed bone—both of the marrow cavity and the compacta—by an osteitic new bone formation. These cases undoubtedly correspond to those spoken of by Arthausen (1) in which the bone surface appears smooth and in which periosteal involvement cannot be satisfactorily demonstrated. However there are two other characteristic findings in juvenile osteitis fibrosa which afford us further means for differentiation.

1 The tendency toward the formation of cysts in the newly built fibrous osteoid mass which particularly in this juvenile type are not infrequently encountered

2 The occurrence of isolated and dense spongy foci in otherwise uninvolved spongy bone

The roentgenological demonstration of either of these changes would permit us to exclude lues. In doubtful cases the clinical picture, the Wassermann and biopsy are additional aids toward making a differential diagnosis.

However apart from the difficulties in diagnosis in the juvenile form of osteitis fibrosa we are able to differentiate the hyperostotic deforming type of syphilis of the long bones from osteitis fibrosa deformans by means of the roentgenogram alone.

This is excellently illustrated by the following clinically observed case.

CASE 81. A man age 43 years factory inspector was admitted May 3, 1933 to the 2nd Medical Service (Prof. Richter). Patient's father died at 56 of dropsy, mother was ex-cull. He has five brothers and sisters, all died at birth and the rest in the first year of life. Patient is youngest child. The mother had a positive Wassermann.

The patient does not remember any diseases of childhood. At the age of 6 he slipped while playing and fractured his right femur. The fracture healed well. At the age of 14 he suddenly had a paralysis of the muscles of the right arm and right side of the neck. The right arm paralysis remained the musculature becoming atrophied. Several weeks after the onset of paralysis he noticed a hard bony mass on the right lower arm which in a short time enlarged to its present size and appearance. After several months similar hard swellings were noticed on both tibiae. On the right side the tibia became bowed and shorter in length. The swelling on the tibia increased in size until his eighteenth year. At that time he was in an institution for crippled and a being treated by massage and movement. Patient denied venereal disease and has never had any anti-luetic treatment. Patient was admitted to the hospital for a supposed grippe.

Physical examination: Patient is moderately well built, male, 155 centimeters tall, plethoric but quite strong. In general the bones and muscles are gracile. His skull shows a large external occipital protuberance. It is somewhat oxycephalic, the brow being a little recessed. The pupils are unequal, irregular and react to light and accommodation. There is slight listhesis of upper thoracic spine to the left.

A lesser scoliosis (compensatory) to the right below. The spinous processes of the eleventh and twelfth thoracic vertebrae are thickened. The clavicle is also thickened. The epigastric angle is acute and narrow. The thorax is flat and long. The whole right side appears smaller and expands less with respiration. The borders of the lung are low on both sides and move moderately with respiration. The breath sounds are vesicular, no dullness. The heart sounds are regular and clear. The abdomen is soft, the organs negative. The liver and spleen are not palpable.

The right arm is held in adduction and is sharply flexed at the elbow. The hand is held in volar flexion, pronation and abduction. The index finger is held straight. The other fingers are slightly flexed. The musculature shows a marked degree of atrophy and is spastically paralyzed. The scapular musculature is atrophied. The humerus is 36.5 centimeters long, radius 27.5 centimeters, the ulna 24.5 centimeters, circumference of forearm maximal 20 centimeters, distal end 13 centimeters.

The left upper arm and hand are normal except that the little finger is in the hammer position. The left forearm is markedly deformed. The distal end of the radius and the proximal end of the ulna are thickened, being club-like in shape with uneven protuberances. Dorsal flexion of the hand is possible only to the horizontal plane. Pronation and supination are limited. The humerus is 38 centimeters, the radius 29 centimeters, the ulna 28 centimeters. The circumference at proximal end 19.5 centimeters, distal 19.5 centimeters.

The gait is rapid and sure. Both thighs are normal. The quadriceps muscles are well developed. Both legs are markedly deformed. The tibiae are felt thickened and bumpy, though they cannot be sharply palpated. The tibiae are bent forward and outward. The right foot is rotated outward in the plantovalgus position.

#### Measurements

	Right	Left
Length Antero superior spine to calcaneus	100	106
Lower border patella to external malleolus	44	45.5
Circumference of leg 7 cm below patella	39	42
Middle of calf	34	40
Malleoli	30.5	21

The patellar and Achilles reflexes are active and equal. Babinski of right leg questionable, right triceps and radial periosteal reflex increased.

Examination of urine and stool was negative. Wassermann strongly positive.

Roentgenograms of left tibia and fibula (Fig. 11) show the left tibia very markedly bowed with convex anterior while the fibula is straight. The tibia shows extensive changes especially in the anterior half where it casts a large dense shadow, though only a few an relatively insignificant lightened

up areas. More anteriorly toward the skin it becomes less compact and irregular with fine irregular frayed projections. Posteriorly this deep shadow has a cloudy irregular border. The posterior cortical shadows are distinctly seen. Distally at the posterior border there is a small narrow penostosis. There is no actual marrow cavity but instead the general bony structure is light and airy in character. The markings of the meshes are in recte lengthwise. The epiphyses appear normal.

On the anterior surface of the distal two thirds of the left fibula there is a fairly dark flattened wavy periosteal shadow. Distally on the posterior surface there is also a small penostosis. The anterior and posterior cortical and the narrow cavity are well defined.

The picture of the right tibia and fibula (Fig. 12) is very similar to that of the left leg the tibia however being less bowed. The fibula is straight. Similarly there is a dense shadow on the anterior part of the tibia but it extends further posteriorly in the distal one third and in the upper half of the left tibia. Posteriorly the shadow has an irregular outline appearance. On the posterior surface there is a narrow periosteal shadow. Otherwise with right tibia is very much like the left.

The right fibula shows more marked changes than the left. In the proximal three fifths the cortical and marrow cavity are clearly defined. Both anteriorly and posteriorly there are penostotic thickenings. In the distal two fifths the fibula is thickened to about three times its normal size and casts a dense shadow with a few small diffuse lightened spots. The borders are irregularly serrated and frayed.

Both bones of the left forearm (Fig. 13) are formed and diffusely thickened. Both cast very dense shadows with small lightened areas especially in the lower ends. On the adjacent surfaces of the radius and ulna there are irregular serrated and frayed periosteal deposits. The proximal one third of the radius casts a lighter shadow. Here the cortical and marrow cavity can be recognized though the marrow cavity is filled by the shadow of a fine porous bone mass. In the region on the lateral surface is a fairly dense shadow of periosteal thickening separated from the cortical by a distinct dark cleft.

The bones of the right forearm are thin and atrophic and show a fairly normal cortical and marrow cavity. On the medial border of the radius in the upper one third the shadow of the cortical becomes less compact and merges into a flat hump like periosteal shadow of lesser density. Otherwise there are no pathological changes.

This clinical picture is certainly most unusual. In addition to the deformity of the right arm the result of a cerebral paralysis is luetic in childhood there are the marked anterior outward bowing of both legs the easily palpable coarse changes of the three tibiae and the enormous thickening of the bones

of the left forearm. Even without the strongly positive Wassermann reaction the syphilitic nature of the bone changes can be readily determined from the roentgen pictures alone (Figs. 11, 12, 13). We have seen the tremendous osteopenostitis of both bowed tibiae the osteopenostitis of the straight right fibula as well as bony penostosis of the left fibula the diffuse osteopenostitic hyperostoses of the left forearm bones and the marked outward bowing of the radius because of its increased length. In the proximal third of the atrophic right radius there also was a bony penostosis.

Characteristic to the changes in these sabre tibiae is the excessive participation of bone and penostium in the anterior circumference. In the posterior circumference of the left tibia remains of the original compacta can still be recognized. Here also a portion of the original marrow cavity is preserved. The characteristic axial arrangement of the meshes of the newly built bone filling the marrow cavity of the right tibia is very clearly seen in the roentgen picture. Thus in addition to the penostotic involvement and the obliteration of the marrow cavity the third diagnostic characteristic of syphilitic hyperostosis is also present.

The combination of elongation and bowing of the radius with bilateral sabre tibia makes this the counterpart of the case of congenital lues observed by Still (29).

#### CONCLUSIONS

1. There are gross anatomical and clinical resemblances between the hyperostotic form of syphilis of the long bones and osteitis fibrosa both the senile hyperostotic porotic form (Jager's disease) and the juvenile endosteal type (L. Pick). Coarser gross morphological similitudes such as deformities elongation and bowing and especially the sabre blade form of tibia are found in the affected bones of both diseases.

2. Despite these external similarities we are dealing especially in regard to their histogenesis with two fundamentally different diseases. The essential difference in their nature expresses themselves in the individual anatomico-pathological characteristics of the affected bones and also in their roentgen pictures.

3 Characteristic of hyperostotic syphilis are (a) the marked often tremendous participation of the periosteum (b) the more or less advanced narrowing and obliteration of the marrow cavity (c) the sclerotic or finely porous quality of the newly built bone tissue. The meshes or pores particularly in the roentgen pictures seem to be directed lengthwise parallel to the long axis of the diaphysis.

The sabre blade or sabre sheath form of tibia in syphilis may be due purely to a periosteal new formation of bone i.e. a pseudo bowing (Fournier) or to an osteitic rebuilding and elongation resulting in a true bowing (Wieting).

4 Characteristic of the senile hyperostotic porotic form of osteitis fibrosa (Paget's disease) are (a) the absence of periosteal participation (b) the very great widening of the marrow cavity even into the epiphyses (c) the frequent lengthwise splitting up of the compacta into lamellae. The sabre blade tibia of Paget's disease is the result of the rebuilding and elongation of the bone i.e. a true bowing.

5 In the juvenile endosteal hyperostotic porotic form there also is a complete absence of periosteal involvement. Only these latter cases may be difficult to distinguish roentgenologically from congenital bone syphilis.

The occurrence of more or less well formed cysts or of single circumscribed dense foci accompanying a diffusely spreading osteitic new bone formation are diagnostic points in favor of osteitis fibrosa as against lues. In the remaining still doubtful cases additional clinical methods should be employed to arrive at a diagnosis.

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## TUBERCULOSIS OSSIFICANS

DR. H. K. WAHL, M.D., CHICAGO, ILL.

**COMPLICATION** of soft tissue is fairly common while calcification apart from the formation of the normal skeleton is much less frequent. It is believed in this note to represent an osseous lesion apparently and usually associated with indurated tuberculous nodules of the uterus.

A fairly careful search of the literature has been made with it (only a similar case). The author herein reported have also been reviewed with Dr. A. I. Hertzler who works on The Lenticulum, widely known. He states that in over 10,000 titles on the petit neume he has not found mention of anything of this character.

The maxilla measuring 4 by 3 by 1 millimeter was found about the tip of an inguinal appendix. It was surrounded by a nodule which closely adhered to the maxilla in all its non-appendicular attachment. The portion attached to the appendix was so firmly fixed that the peritoneal cut was stopped off in delivering the mass.

The maxilla and the appendix were submitted to Dr. H. K. Wahl, pathologist of the University of Kansas School of Medicine who has given the following report (in part) and made the accompanying photomicrograph of the sectioned maxilla.

**Cross section.** There are two pieces of tissue, one is a rather hard set one like tissue. It is apparently a calcified mass, a calcified mass. The irregular nodular surface.

The other piece of tissue consists of an appendix. Its outer surface is completely roughened. It feels indurated. The wall is thickened. The lumen is almost obliterated. At a point of the distal

end a part of the serosa and muscularis is torn off.

**Histological pathologic.** A section through the bone or calcified mass shows irregularly shaped nodules with irregular areas of calcareous material at one side. Between the lacunae and parts of the bone trabeculae there is loose connective tissue. The lacunae may be seen through out the bony trabeculae.

**Section of appendix.** The picture suggests that of subacute inflammatory reaction situated mostly around the appendix rather than within it. There is something to suggest well preserved.

**Distal end.** The process of invagination of the appendix with a acute peritonitis.

**Longer part of the appendix.** Apparently this represents a calcified mass in a mass of old chronic inflammation tissue surrounding the appendix, a remnant of the inflammation here.

The following facts as from the patient history are of interest.

At 10 years of age is told that he had a right leg was in a cast for a year. He was in the hospital for a year. He was in the hospital for a year. He was in the hospital for a year.

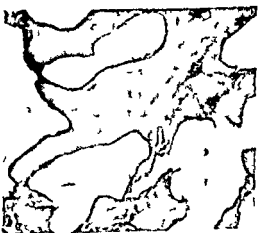


Fig. 2. Appendix, photomicrograph of the distal end.



Fig. 1. Appendix, photomicrograph of the distal end.

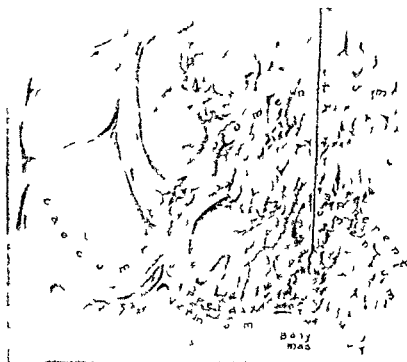


Fig 3 A large, irregular, white mass of omentum

15,800 polymorphonuclears 86 percent pulse 86 temperature 99 degree F Wassermann four plus Vaginal examination showed a tender mass in the region of the right adnexa about 6 centimeters in diameter

At operation May 2, 1944 at St. Mary's Hospital the writer performed a bilateral salpingectomy and appendectomy

After the operation the writer recorded on the patient's gross pathology record: The appendix was atrophic, adherent to the omentum, had a thick, short meso-appendix and adherent to the serosa of its tip as a deposit apparently calcareous about

the size of an ordinary white bean. Adherent to this mass also were folds of omentum.

It appears that this specimen is unique enough to merit being recorded among the rare forms of ossification.

The writer invites discussion of the opinion and finding of others which may bear on this subject. Since finding this specimen I have learned of two peri-appendiceal calcifications without ossification in the practice of other surgeons.

## FATTY TUMORS OF THE UTERUS

By ALLEN C STARRY M D S O U T H C I T Y I O W A  
F o m t h P h i l o g i c I L a b o r y f i s J o s e p h M e r y H p u t a l

CASE reports of uterine tumors characterized by varying amounts of fat tissue are rare. Schleussner (5) in 1921 reviewed the literature and at the same time reported a case of lipoma of the uterus. In his paper he gave a brief review of the cases reported prior to 1921 and cited Seydl's paper for a review of the cases prior to 1903. Including his own case he could find reported only 17 cases of undoubted fatty tumors of the uterus. Of these tumors 7 including his own were listed as simple lipomata. The other 10 tumors were classed as lipomyomata. Four occurred as cervical polyps the remaining 13 as tumors of the body of the uterus. About the same time Andrews (1) reported a case of a uterine tumor in which fat tissue was found. He listed his tumor under the heading of lipomatosis of the stroma of a uterine fibromyoma.

In view of the rarity of these tumors it would seem worth while to report a case of a fatty tumor of the uterus that occurred on the surgical service of Dr P B McLaughlin.

Mrs B age 64 years was admitted to the hospital September 22 1924 complaining of frequent urination and a dragging sensation in the pelvis. She stated that she had suffered this pelvic distress from time to time for the past 30 years. There was no history of uterine bleeding. Menstruation began at the age of 11 years had been regular and of the twenty eight day type. The menopause occurred at 50 years of age. She had had 3 normal pregnancies and 2 miscarriages. The patient was moderately well nourished. Examination revealed a large cystocele with the cervix at the introitus of the vagina. The uterus was very large and was tipped back into the hollow of the sacrum. A diagnosis of fibroma of the uterus was made and a total hysterectomy together with a repair of the cystocele was done under local anesthesia by Doctor P B McLaughlin September 23 1924. Recovery was uneventful.

**Gross findings.** The uterus and tumor measured 8 1/2 by 11 centimeters. The perimetrium was perfectly smooth. The cervix was attached and stretched out 8 centimeters long. The tumor was sectioned and was found to be of the intramural type. It occupied all of the posterior and right

lateral wall of the uterus. The uterine cavity was pushed to the left and was markedly distorted by the tumor mass. The entire tumor was covered with about 5 millimeters of uterine muscle tissue. The endometrium was smooth somewhat hemorrhagic and rested upon about 2 millimeters of muscle fibers. Sections of the tumor presented a very lobulated structure in fact the lobules could be easily separated with blunt dissection and peeled out with ease. The lobules varied in size from that of a cherry to the size of a hen's egg and were very irregular in shape. Some of the lobules were white and firm and had the appearance of an ordinary lobulated fibroma while others were soft and edematous. One lobule especially was dark yellow soft and appeared like a large lobule of fat. The cut surface protruded above the surface of the other lobules. On closer inspection one could note small yellowish areas scattered through all the lobules. The lobules were separated with a small amount of loose connective tissue carrying many blood vessels. These vessels would run great distances in the tissue before they would finally turn abruptly and disappear in the substance of one of the lobules.

**Microscopic examination.** Sections stained with hematoxylin and eosin taken from various parts of the tumor showed it to be made up of true fat tissue fibrous and smooth muscle tissue. The fat cells were large with the usual flattened nucleus pushed to one side giving the cell the typical signet ring appearance. In the larger areas the fat cells were closely packed and were polyhedral in shape. Bands of connective tissue passed through the larger areas of fat and occasionally small islands of smooth muscle cells were noted. Sections from the more fibrous areas showed many fat cells scattered throughout either in small groups or singly. Van Gieson's stain showed a large amount of connective tissue containing varying amounts of smooth muscle fibers. The coarser collagen fibers could be easily made out and the smooth muscle fibers could be readily differentiated from the connective tissue. Some areas showed beginning hydropic degeneration of the connective tissue while others showed marked hyaline change. The fat stained readily with fat stains. Frozen sections were made and stained with Sudan III. The fat globules stained bright red and in each large globule many fatty acid crystals could be seen.

## DISCUSSION AND CONCLUSION

The histogenesis of fatty tumors of the uterus has been variously interpreted by different authors. This has led to con-

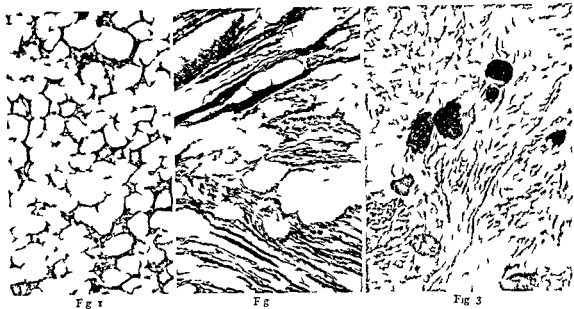


Fig 1

Fig 2

Fig 3

Fig 1 Fatty portion of tumor, low power  
Fig 2 Low power view of stromal portion of tumor  
fibrous portion

Fig 3 Low power view of osmic acid preparation showing the distribution of fat cells in the fibrous portion

siderable confusion and as a result these tumors have been variously named as lipomata lipomyomata fatty tumors of the uterus and lipomatosis of the stroma of a uterine fibromyoma. The more recent authors who have discussed the histogenesis of these tumors seem to think that the bulk of the evidence in their case was on the side of the lipoblastic displacement theory advanced by Seydl Cohnheim's embryonic cell rest theory has also been advanced. Others have thought that the fat came from the ingrowth of true fat tissue along the blood vessels and nerves. Lastly the muscles and connective tissue cells were thought to have taken up fat in the globular form thus becoming true fat tissue.

With the hope of throwing some light on the origin of the fat in these tumors a careful search was made of sections from numerous blocks taken from various portions of the tumor for the presence of fat droplets in the connective tissue or muscle cells. Frozen sections were first used and stained with Sudan III. The fat stained a bright red and could be easily detected. All sections showed so many small globules and droplets of fat

dispersed by the microtome knife over the surface of the sections and even down between the tissue fibers that it was impossible to differentiate between the globules and droplets so dispersed and those deposited during growth of the tumor. In order to overcome this difficulty blocks of tissue 1 centimeter square and 5 millimeters thick were cut from the more fibrous areas of the tumor and washed several days in distilled water. The blocks were then placed in 1 per cent osmic acid for 8 days in the incubator at 37.5 degrees C. The blocks were next washed several days in 70 per cent alcohol and dehydrated cleared in chloroform and finally run into paraffin blocks.

Sections from these blocks showed the fat to be stained jet black and not dispersed in small globules over the surface of the sections as in the case of the frozen sections. Fat cells were found in all sections. They occurred usually in the bands of connective tissue but frequently fat cells were found in close proximity to bands of smooth muscle fibers.

Closer study revealed occasionally cells containing small droplets of fat stained black with osmic acid. The droplets varied in size





Fig. 4 (left) Fibroblasts (fibroblasts) in connective tissue.

Fig. 5 High power view of fat cell. The globules are surrounded by fibroblasts. The globules are not in the same plane as the fibroblasts. The globules are superimposed and the large area of fat is the photomicrograph of the produced.

from small specks to one fourth the size of a red blood cell. These cells were not numerous and were only occasionally noted. They occurred in bands of connective tissue closely packed between the collagen fibers. They were somewhat larger than ordinary connective tissue cells. Some of the cells were spindle shaped while others were stellate and irregular in shape. In some areas they appeared much as young fibroblasts with long protoplasmic processes connecting one with the other. The nucleus was large centrally located and was very granular. The fat droplets when present occurred either in small collections at one or both poles of the nucleus or they were distributed in the cytoplasm in the immediate vicinity of the nucleus. Attempts to demonstrate fibroglia fibrils in connection with these cells failed. These cells were never found in bundle of smooth muscle fibers. Again a number of other areas were found in which collections of

small globules were noted. Sometimes there would be one larger globule with 4 or 5 smaller surrounding globules. Other areas would show a collection of 7 to 12 distinct small globules. These collections of globules were usually surrounded with an area of fine fibrillar connective tissue as shown in the photomicrograph (Fig. 5). Careful study under high power showed these droplets and globules to be distinctly inside tissue cell and not collected upon the tissue cell as an artifact. The photomicrographs I think will show this. However the number of distinct droplets and globules and their position can not be appreciated fully except by focusing with the microscope and noting the different level. Single fat globules were not taken into consideration as it was not possible to differentiate such single globules from portions of large fat cells cut near one pole.

Since these developing fat cells occurred always in the presence of connective tissue

and since fat droplets could not be found in cells which could be proven definitely to be smooth muscle cell I feel that one is justified in placing these cells in the connective tissue group. They then must represent either the type of connective tissue cell commonly found in the uterus and tumors of the uterus or they represent some specially differentiated type of lipogenic connective tissue cell. Therefore the fat tissue must be derived from either of these two groups. According to Bailey and Miller (3) fat tissue develops from embryonic connective tissue cells. The fat replaces to a great extent the cytoplasm in many of these embryonic cells. These cells first appear in the axilla and groin of the fetus about the thirteenth week. Fat is formed in other places at later periods and even during adult life but the mode of development is always the same. The whole question as to the origin of these fat cells depends upon whether fat cells develop from any embryonic connective tissue cells or whether they develop from specially differentiated embryonic connective tissue cells. According to Bailey ( ) this question has not been definitely settled.

It would seem that the fat tissue in these tumors must arise from some specially differentiated connective tissue cells. If fat could develop from the connective tissue commonly found in uterine tumors one would expect to find more tumors of the uterus containing fat tissue. But from the literature it is evident how infrequently fat tissue is found in tumors of the uterus. Even fatty degeneration is

rare. As pointed out by Elkin and Haythorn (4) in their paper quoting McDonald only 7 cases out of 530 reported by various authors showed even this change. Furthermore fat tissue is never found normally in the uterus tubes and ovaries.

Since congenital remains and displacements frequently occur in the female genital tract one must necessarily consider the possibility of the fatty tumors developing from lipogenic displacements. These embryonic cells may remain in the uterus and in later life take part in producing the fat in these tumors. For a general discussion of the various theories as to the histogenesis of these fatty tumors of the uterus I refer the reader to the papers of Schleussner and Elkin and Haythorn and to the bibliography there given.

This case shows that developing fat cells may be found in fatty tumors of the uterus. These fat cells develop from connective tissue cells which probably represent a specially differentiated type of connective tissue cell.

At this time I wish to express my indebtedness to Doctor F. B. M. Laughlin of St. Joseph's Maternity Hospital for the privilege of reporting this case.

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# A STUDY OF THE INTRAMURAL PORTION OF NORMAL AND DISEASED TUBES WITH SPECIAL REFERENCE TO THE QUESTION OF STERILITY<sup>1</sup>

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**I**n the many careful descriptions of the normal anatomy and histology of the fallopian tubes most of the attention has been centered on the free intraluminal portion.

Recently Hermstein and Neustadt<sup>(1)</sup> published the results of their studies of the intramural portion of the fallopian tubes in 15 normal cases. They found that contrary to the usually accepted belief the intramural portion of the tube did not run a direct course from the uterine ostium through the uterine wall but that there were two distinct ways in which it traversed the uterus. In one the tube took a more or less direct course and in the other it was a convoluted or angulate one. The frequency of the two types was about equal. They found that both tubes in each instance conformed to the same type, i. e., when one side was direct the other was also direct.

They also found that the uterine ostium was not a definite fixed point but that the uterine cavity was drawn out into a funnel at the apex of which the tube begins. In two instances there was a direct differentiation, sharp and well defined, between the gland bearing uterine mucosa with its stroma and the single layered epithelium with cavity stroma of the tubal mucosa. In most instances, however, there was a so-called transitional zone where the mucous membrane of the uterus had few or no glands and the stroma was entirely absent there was a cavity tunica

propria and the tubal epithelium presented no villi.

The tube proper which can be recognized by the typical well-developed musculature stands out very prominently. The outer circular muscularis is poorly developed. The mucosa shows typical high cuboidal ciliated epithelium with no distinct villi but suggestions of folds. These folds occasionally become a little more prominent as the isthmus is approached.

Kuestner<sup>(4)</sup> denied the occurrence of villi in the intramural portion of the tube while Cruselow<sup>(5)</sup> and Troellen<sup>(6)</sup> described typical folds.

Hermstein and Neustadt point out the difficulty even the impossibility of probing or distending except by intratubal growth, this intramural portion. The lumen is only 0.5 to 1 millimeter and the entire course is surrounded by a dense unyielding uterine musculature.

Our studies on the intramural portion of normal and diseased tubes were carried out on extirpated organs. These were obtained by operation and included the uterus and annexa. The specimens were prepared by



Fig. 1. Normal fallopian tube showing the intramural portion. The tube is shown in its natural position, with the uterine end on the left and the fimbrial end on the right. The intramural portion is clearly visible as a dark, rounded area in the center of the tube.



Fig. 2. Normal course showing a slight deviation on the left and tortuous course on the right.

tying the tubes when they appeared grossly patent at the fimbriated extremities insufflating and later by means of a piston syringe injecting the uterus and tubes with a 20 per cent sodium iodide solution. The cervix was then tied to prevent the escape of the fluid and an X-ray photograph taken of the organs. When the tubes were closed by adhesions no ligature was necessary. The amount of pressure necessary to inject the diseased tubes was often considerable. In some instances the fluid in spite of tremendous pressure could not be forced into the tubes. After the X-ray photograph was taken the uterine horn and the intramural portion of the tubes were removed and fixed. Blocks were cut approximately 0.5 centimeter in thickness and embedded. These were cut as interrupted serials that is every fifth to eighth section of 15 microns was saved stained and mounted. In some instances no injection was done just serial sections cut with these as controls to rule out any possible error due to the effect of the iodide solution on the epithelium or tubal



Fig. 3. Normal course showing direct course of one on the left and L-shaped course on the other.

lumen. It can be readily understood that in some instances because of the pressure exerted in injecting the tubes a partial passage of fluid was made where under normal circumstances the lumen would not be traversable.

Rubin (5) reported a few cases in which he had injected 10 per cent collargol to determine the patency of the tubes. This was done on the living patient and X-ray photographs were taken. The results were apparently not satisfactory for nothing else was published along these lines until his valuable method of gas insufflation was described.

Kennedy (3) published a series of 18 cases in which he injected the tubes and uterus with a solution of sodium bromide and took X-ray photographs. This also was done on living patients. In addition insufflation was done in these cases. In 1 the tubes were partly occluded in 17 absolutely occluded. In 3 cases of occlusion no shadow was obtained in 1 in which the tubes were partly occluded there was also no shadow that is the bromide solution passed into the abdomen. Of 6 other tubes showing a negative insufflation test 8



Fig. 4. Showing bizarre form of intramural course. A complete loop on the left and gentle curve on the right.



Fig. 5. Normal course in a fibroid uterus showing the occluded type on the left and sharply angulated on the other.



Fig 6. Mucosa with fibroblasts. Typical uterine muscle.

showed no tubal shadows that is there was an obstruction in the cornu or isthmus and 18 showed obstruction only at the fimbria.

This is a most important step in conjunction with the insufflation tests if an accurate



Fig 8. Transition from mucosa to inner type of gland and beginning of large communicating glands. The thick layer by high cylindrical epithelium.



Fig 7. Transition from mucosa to inner type of gland and beginning of large communicating glands. The thick layer by high cylindrical epithelium.

method is to be devised to relieve the condition of sterility due to occlusion of the tubes.

Our studies were undertaken to determine the type of lesion that causes the obstruction as well as the site of the obstruction.

We can substantiate the finding of Hermstein that the intramural portion of the tube presents a varied course through the uterine musculature. The uterine cavity expands in



Fig 9. Showing the intramural portion of the tube with a thickening of the muscular band.

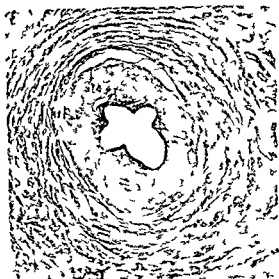


Fig. 10. Intestinal part of tube. Circular type. Not muscular.

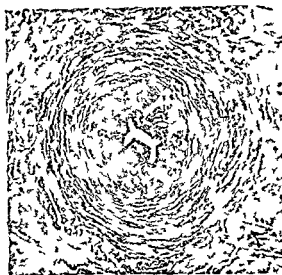


Fig. 11. Intramural part of tube. H-shaped. Not muscular.

its upper portion into a cone shaped extension on either side. This gradually narrows down and its apex is continuous with the tubal lumen. From this point the tube presents many variations. Its caliber varies from 0.5 to 1 millimeter and its length from 1.5 to 5 centimeters. In about 40 per cent of the cases it passes in a gentle direct curve with the convexity upward through the wall of the uterus until it emerges (Fig. 1). Occasionally it rises in a steep curve more or less abruptly from the uterine funnel (Fig. 12).

In the remaining cases the course is not a simple direct one but tortuous either traversing the uterine wall in a series of gentle convolutions up to 4 in number or in a course marked by decided angulations either 1 or 2 in number (Fig. 2). In the angular course the tube usually rises sharply from the uterine cone to within a few millimeters of the per-



Fig. 12. Intramural part of tube. High magnification. Located beneath the mucosa and is the muscularis.

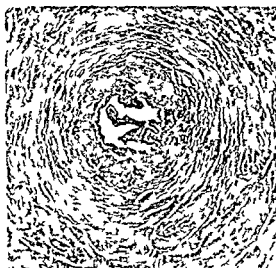


Fig. 13. Intramural part of tube just before isthmus. Noted swelling and fibrillation with increased epithelial development and changes on

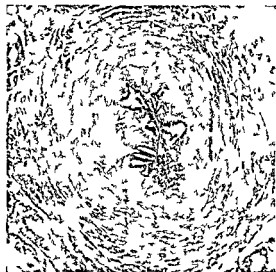


Fig 14 Intramural portion of fallopian tube showing glandular formation of pseudoglands and adhesions of peritoneal surface completely including the men

toneal surface then sharply bends down again until it emerges. Occasionally just before or at its point of departure from the uterus it again makes a sharp angle giving it an L-shaped point of exit (Fig 3a) or other bizarre forms (Fig 4). The tubes may be symmetrical in type but often one side may present the



Fig 5 Intramural portion showing the fallopian tube and the structure of the fallopian tube

gradual simple curve while the other may show the convoluted or angular type (Figs 1, 2, 3, 4 and 5).

The gradation from the uterine to the tubal mucosa is as a rule a slow transition as has been described by Hermstein though occasionally we also have found an abrupt differentiation. The upper end or narrow portion of the uterine funnel presents the typical uterine epithelium (Fig 6). This gradually fades out into a mucosa where the glands are fewer in number, more irregular in outline and more closely grouped as if preparing to fuse to form the tubal lumen. They have a more feathery appearance and the cells themselves become high slender and cylindrical in type. The stroma is less cellular and the tunica propria is scanty. This can be termed the transitional zone (Figs 7 and 8). From this point there is a rapid change with loss of all glands disappearance of the cytogenous stroma and the beginning of the well developed mass of longitudinal musculature under the tubal epithelium.

The tube can be definitely recognized not only by the change in the mucosal type but also by the well marked and rapid development of the longitudinal muscular coat situated just below the mucosa.



Fig 5a Intramural portion showing the fallopian tube and the structure of the fallopian tube

The normal tubal mucosa in the intramural portion does not present definite villi. It shows a varying grade of low simple protuberances from 1 to 3 in number. One may get many varieties of lumen but all widely patent. The contour may be oval or clover leaf may be shaped like the letter H or like a cross. The villi if one wishes to call them so are simple and broad not occlusive (Figs 9 10 and 11). Occasionally there is just a slit like lumen without elevations.

The detailed histology has been already accurately described by many authors.

The musculature already mentioned stands out as a very distinct layer (Figs 9 10 and 11).

It enables one to pick out grossly the tube from the vessels in the cross section of the uterine horn. The bundles are heavy run parallel to the course of the tube and are accompanied by broad bands of fibrous tissue. The layer of muscle diminishes rapidly in thickness as the free intra abdominal portion of the tube is approached to lose itself in the circular musculature. In the true intramural portion the outer circular layer is thin and narrow and lies completely surrounded by the uterine muscularis for some distance and only near the point of emergence does the



Fig. 8. Fallopian tube showing each part of the tube. The left side with marked lumen. The right side with complete occlusion.

layer present itself poorly developed but definite. It is this situation in the unyielding uterine musculature in combination with its varied course that makes the probing of the tube from the abdominal side impossible.

A strange fact that we have as yet not entirely explained is the lack of distensibility of not only the intramural portion of the tube but the first 2 centimeters of the free portion. We believe that it is due to the firmness and rigidity imparted not only by the uterine muscle

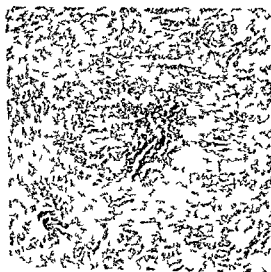


Fig. 6. Complete obliteration of the lumen of the fallopian tube. Spaces are filled.



Fig. 7. Aleromyomatous fallopian tube. The fallopian tube is completely obliterated by the fibrous tissue.





Fig 9 Dissected tube with closed fimbriae. Solution of saline into tube. The distal end of the tube is the site of pus in tube. Incision into tube. It is injected with iodine solution in the sac.

lars but also by the well developed longitudinal muscular band.

The conditions found in the intramural portion of chronically diseased tubes are most varied. We took cultures from all the tubes to determine if any organisms still persisted and found that in the tubes studied the cultures showed no growth. In other words the lesions represented the end results of the inflammatory process. The tubes grossly showed closed clubbed fimbriated extremities or occasionally patent fimbriae with peritubal adhesions or distortion. In this way the retort shaped by dysosalpinx or pyosalpinx was accounted for. Of course for the purpose of this investigation the pyosalpinges or tubo ovarian abscess played no great rôle but they illustrated the frequency of the lesions to be described.

In most of these diseased types definite pathological lesions were found in the intramural portion of the tube. We found fre-



Fig 10 Tube with patent fimbriae. The distal end of the tube is the site of pus in tube. Incision into tube. It is injected with iodine solution in the sac.



Fig 11 Dissected tube. Right has closed fimbriae. The collection of pus is distal to the intramural portion. The distal end of the tube is the site of pus in tube. Incision into tube. It is injected with iodine solution in the sac.

quently a definite oedema of the mucosa with an infiltration of round cells and increased vascularity resulting in sufficient swelling and thickening of the mucosa to cause some obstruction (Figs 12 and 13). Again one finds adhesions between the small protuberances forming numerous small lumina some ending blindly and forming pseudo glands showing often the same inflammatory changes described above (Fig 14). In some instances the desquamation of the epithelium leads to the healing together of adjacent surfaces dividing the lumen into two canals (Figs 15 and 15a) or even may be so extensive as to completely close it with a scar or to present only a collection of round cells where once there had been a definite lumen not unlike the obliterative process seen in old diseased appendices (Fig 16).

Another interesting and rather common finding in these old inflammatory cases was



Fig 12 Fallopian tube with patent fimbriae. The distal end of the tube is the site of pus in tube. Incision into tube. It is injected with iodine solution in the sac.

the presence of a definite adenomatosis of the uterine cornu. In the uterine horn the glandular proliferations could be traced directly to the uterine mucosa. This adenomatous condition often extended alongside the intramural portion of the tube occluding it somewhat. We could not trace these glandular elements to the tubal lumen (Fig 17). This type of lesion when it involves the tube proper has been termed *salpingitis isthmica nodosa*.

In passing it may be noted that in some instances in non-inflammatory cases we found a definite obstruction to the tube of neoplastic nature at its intramural portion. In some instances cornual polyps and in 2 cases small fibroid nodules 1 centimeter in diameter were so situated in the horn as to occlude completely the tubal lumen (Figs 18 and 2).

The X-ray photographs of the iodide injected organs in the diseased cases are most instructive. It can be seen how in many instances the iodide solution fails to pass the uterine cornu (Fig 19). Again one can see it extend inward a short distance and collect in a small mass at the interstitial portion of the tube possibly because the solution accumulates in the dilated blind pseudo glands formed by the adhesions of the tubal surface or in the glandular structures of the cornual adenomyomatosis (Fig 20). Occasionally it passes the obstructive points to accumulate in small amounts between these points (Fig 21). It is possible that the great amount of pressure exerted may have forced the fluid beyond the obstructing lesions (Fig 19). Again we found that in tubes with grossly patent fimbriae and evidences of peritubal inflammation the iodide solution could not be forced past the uterine horn because of an obstructive lesion the result possibly of a completed tubal infection (Fig 5).

Whenever the interstitial portion of the tube permitted the passage of the solution the terminal portion of the tube was distended (Figs 19 and 21). We were never able to distend the interstitial portion or the first portion of the isthmus probably because of the thick intrinsic and extrinsic muscular support of the tube. As was previously mentioned the interstitial portion of the tube presents just under the mucosa a thick band of longitu-

dinal muscle and a thinner interrupted band of circular muscle. As the tube progresses to the free portion the strong inner longitudinal bundles gradually decrease in thickness and disappear the circular muscle remains as a thin layer and outside of this develops a scattered incomplete longitudinal layer. The contractility of this interstitial portion is great its lumen small and these facts may explain why it is rarely distended. It explains why when these fresh organs are injected (still living) the fluid is forced out by the muscular contraction into the distensible distal portion. It may also explain the shape of the typical pyosalpinx or hydrosalpinx.

When we review the importance of these findings both in the normal and diseased tubes we note that they have a distinct bearing on the question of sterility.

The normal variations in the tubal course may of itself present difficulties for impregnation. Tubes that have a decided convoluted course or exaggerated angulations depending on the number and sharpness of the angulations may offer a decided obstacle to the spermatozoa in their ascent or to the ovum in its descent. The interesting question which we can just mention here of the greater barrier offered to the impregnated ovum and the subsequent development of a tubal pregnancy may find at least a possible answer in these variations.

The various types of intramural lesions either inflammatory or neoplastic that have been mentioned offer too an almost insurmountable barrier for spermatozoa and ova even if the lesions are not absolutely obstructive.

In view of the frequency of diseased conditions in the intramural portion that may offer a decided bar to the ascent of the spermatozoa or the descent of the ovum it is essential to determine the site of all obstructions in diseased tubes. The important thing is to determine if the obstruction is only at the fimbriated extremity at the intramural portion or at both places. Probing the tube (whose caliber is from 0.5 to 1 millimeter) is practically impossible as can readily be understood by visualizing the course tortuous and fixed in the uterine horn.

The most reasonable method is that suggested by Kennedy and with a perfection of technique it should prove of inestimable value.

It is obviously useless to attempt a plastic operation on the fimbriated extremity with an occlusive lesion in some other portion of the tube.

The interpretation of the insufflation test must be somewhat changed in the light of these findings. The variations of the normal intramural tubal course with its convolutions and sharp kinking so frequently seen may account for the marked variations in pressure required to obtain a positive test. A high pressure may not mean an abnormal intramural obstruction simply an obstruction due to the angular tubal course. A sharply kinked intra uterine course with a contracting uterine muscle may give a negative test and at some subsequent time when the uterus is relaxed the test will be positive. It too may happen that in a patient with a negative test a laparotomy will demonstrate a patent fimbriated extremity and a test done with the abdomen open will be positive. This too may be due to the relaxation of the uterine contraction and a partial straightening of the intramural course. So we see that we may get either a positive or a negative test in normal tubes. It is essential to determine the cause of the negative test to obviate if possible the performance of an unnecessary laparotomy. A positive test under pressure in a normal tube means that the tube is patent for gas yet the spermatozoon making headway against the current caused by the action of the cilia must also surmount the obstacles of the kinks and angles that may be present. Likewise the ovum in its descent must be swept over the obstructing ridges in a portion of the tube that is rather rigidly fixed.

So too in a diseased tube one may get a positive or a negative test. Here it must again be emphasized that a positive test means patency under pressure for gas and not necessarily for spermatozoa or ova.

One may get a negative test in diseased tubes with patent abdominal ostia and an obstructive lesion in the intramural portion of the tube. A negative test is also obtained in cases with an occluded fimbriated extremity

with or without an occlusive lesion in the intramural portion.

It can readily be seen that operative interference which is designed to make patent the abdominal portion of the fallopian tube will prove valueless if an intramural lesion is present.

Still one more factor that must be considered and investigated is the persistence of the inflammatory process. An attempt at conservative plastic surgery if the inflammatory lesion has not completely subsided even when the process seems limited to the fimbriated extremity may result in occlusive lesions in the tube that will vitiate any operative correction of the lesion at the abdominal end.

### CONCLUSION

1 Variations in the course of the intramural portion of normal tubes may offer a bar to impregnation.

2 Intramural lesions may make the passage of sperms or ova impossible.

3 Intramural lesions may be present with or without closure of the fimbriated extremity.

4 One may get a positive or negative in insufflation test in normal tubes.

5 One may get a positive or negative in insufflation test in diseased tubes.

6 A positive insufflation test means that tubes are patent to gas under pressure not necessarily to spermatozoa or ova.

7 It is essential to locate the occlusion in a case with a negative test if any reasonable hope of assistance from operative procedure is to be entertained.

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THE VALUE OF THE LEUCOCYTE COUNT AS AN AID TO DIAGNOSIS IN ECTOPIC GESTATION<sup>1</sup>By LILIAN K. P. FARRAR, A.B. M.D. F.A.C.S. NEW YORK CITY  
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THE wide variation of the leucocyte count in ectopic gestation even over a comparatively short period of time had made it seem to me unreliable in diagnosis of that condition until the daily counts which we had made for 6 months on the first division of the Woman's Hospital in postoperative cases revealed to me that the leucocyte count is a constantly changing figure in the days immediately after operation. How rapid this change is was shown by the work two of the students in Cornell Medical College did in their elective course in gynecology at the Woman's Hospital. They took the leucocyte count every hour on a series of patients for the first 4 hours following operation and then daily on the same cases as I had done before until the normal leucocyte count was reached. This is reached in the average uncomplicated case on the fifth day. Since the leucocyte count changes so rapidly following operation it seemed to me that possibly it might be that the apparent discrepancies of the leucocyte counts in ectopic gestation are due to the rapid or frequent changes going on in the gestation itself causing the escape of blood into the peritoneal cavity and with a view to studying a number of these leucocyte counts I collected the case histories of 150 patients who had been operated upon in the Woman's Hospital. In each case the pathologist had diagnosed the specimen as an ectopic gestation.

It is the custom for each patient entering the hospital to have a leucocyte count taken the day of admission and as often thereafter as the attending surgeon deems it necessary.

For study and comparison I have separated the cases into three groups. The first Group A includes all the cases that had a leucocyte count below 10,000 the upper limit considered normal in leucocyte counts. The second

Group B includes all cases with a leucocyte count of from 10,000 up to 16,000. The number 16,000 was taken as the limit of Class B because a patient with a leucocyte count of more than 16,000 was clinically in a much more acutely ill condition.

Group C includes then all cases having a leucocyte count of from 16,000 or more and in this series of 150 cases the highest count was 36,350. In every case the last leucocyte count before operation was the one selected. In Groups A and B the last count was made one or two days before operation. In Group C the last count in every case was made on the day of operation.

Leucocytes		Cases	
Group A	4,500 to 10,000	7	49
Group B	10,000 to 16,000	55	366
Group C	16,000 to 36,350	23	153
Total		85	999

Forty eight per cent nearly one half of the 150 cases of ectopic gestation had a normal total leucocyte count just before operation.

In 36.6 per cent more than one third of the cases the leucocyte count was increased 10,000 to 16,000 and in 15 per cent it was increased 16,000 to 36,350.

The polymorphonuclear leucocyte count taken at the same time and the temperature pulse and respiration taken nearest to the time the leucocyte count was made were as follows:

## GROUP A (4,500 to 10,000)

Leucocyte	Temperature	Pulse	Respiration
Below 10,000	98.100	80-90	18-22
10,000-16,000	98.100	80-90	18-22
16,000-36,350	98.100	80-90	18-22
Total	85	999	999

## GROUP A—(Continued)

45 cases	Resp. to	Per cent
27 cases	18 2	62 5
72 cases	22-28	37 5
		100 0

58 cases	P lymph	l
14 cases	Per cent	Per cent
72 cases	50-75	80 5
	75-81	9 4
		99 9

## GROUP B (10 000 to 16 000)

48 c s	Temp. t	Per
1 c	98-100	87 2
6 cases	below 98	
55 cases	100-101 4	12 7
		99 9

40 c s	Pulse	Per cent
9 cases	below 100	72 7
6 cases	below 111	
55 c s	110-124	27 2
		99 9

34 sec	Resp. P	t
cases	8-20	61 8
55 c	2-3	38 2
		99 9

27 sec	P lymph	clear
8 s s	leucocy	count
55 c s s	Per cent	Per cent
	64-75	49
	75-90	5 9
		99 9

## GROUP C (16 000 to 36 350)

10 cases	Temp. t	Per cent
2 sec	98-100	8 6
2 case	below 98	
23 c s s	100-108	7 3
		99 9

1 c s s	Pulse	Per cent
4 s	below 100	43 4
9 c s	below 111	
23 s s s	100-138	56 5
		99 9

9 c	Resp. P	t
4 c s s	8-2	39
3 c s s	3	60 8
		99 9

c	P lymph	pho	lar
c s	leucocy	t	t
1 s	d r 75		
3 s s s	77-90		
	90-96		
			100
			10

A comparison of the three groups was then made to see if any decided alteration in temperature pulse respiration or polymorpho-nuclear leucocyte count could be found and the percentages are as given in the tables.

## COMPARISON OF GROUPS A B C

Group A (below 10 000)	Temperature	Per cent
	98-100	8 9
	below 98 or above 100	18
		99 9

Group B (10 000-16 000)	Temp. t	Per cent
	98-100	87 2
	below 98	
	100-101 4	12 7
		99 9

Group C (16 000-36 350)	Temp. t	Per cent
	98-100	8 6
	below 98	
	100-100 8	17 3
		99 9

High temperature. It is believed that in the case of the 50 cases of ectopic gestation the temperature of the body before paracentesis was 15 degrees F.

Low temperature	Per cent
Group A	5 5
A 4 cases below 98	1 8
B case below 98	8 6
C 2 cases below 98	

## COMPARISON OF GROUPS A B C

Group A (below 10 000)	Pulse	Per cent
	below 100	7 2
	below 111	
	100-111	27 7
		99 9

Group B (10 000-16 000)	Pulse	Per cent
	below 100	7 2
	below 111	
	100-111	27 7
		99 9

Group C (16 000-36 350)	Pulse	Per cent
	below 100	43 4
	below 111	
	100-111	56 5
		99 9

In Groups A and B (7 cases) the temperature of the body before paracentesis was 39 degrees F.

COMPARISON OF GROUPS A B C

Group A (below 1000)

	Respiration	Pulse
45 cases	8-20	62.5
27 cases	22-28	37.5
72 cases		100.0

Group B (1000 to 6000)

	Respiration	Pulse
34 cases	8-	6.8
1 cases	22-3	38
55 cases		99.9

Group C (6000 to 36350)

	Respiration	Pulse
9 cases	8-20	39.1
14 cases	-28	6.8
23 cases		99.9

In Group A and B (cases) 49 cases 37 per cent had respiration higher than Group C 60.4 per cent had respiration 22 or more

COMPARISON OF GROUPS A B C

Polymorphonuclear leucocyte count  
Group A (below 1000)

	Percent	Fresh
58 cases	50-75	80.5
4 cases	7-8	9.4
72 cases		99.9

Group B (1000 to 6000)

	Percent	Fresh
27 cases	68-7	49.0
8 cases	75-9	5.9
5 cases		99.9

Group C (6000 to 36350)

	Percent	Fresh
0 cases	75	
6 cases	77-90	
7 cases	90-96	3
		100
3 cases		100

In Group A 94 per cent were normal  
In Group B 50 per cent were normal  
In Group C 100 per cent were normal

The temperature was not of diagnostic value in this series of cases except that its maximum as noted was 101.4 degrees F

The pulse was increased to 56.5 per cent in Group C but in only 7 per cent of the cases in Groups A and B was an increase noted

The respiration in Groups A and B was nearly the same (38 per cent) but rose to 60 per cent in Group C

The polymorphonuclear leucocyte count was more than doubled in Group B (50 per

cent) over Group A and reached 100 per cent in Group C

The total leucocyte count was increased to above normal in 100 per cent of the cases in both Group B and Group C

The findings at operation—Group A (below 1000)  
Leucocyte Count

	Percent	Fresh
9 Unruptured red in free blood		40.2
2 Partial tubal abortion fluid blood clot		
2 Old tubal abortion fluid blood or clots		
29 Ruptured		59.7
7		99.9

Summary The findings at operation presented two totally different conditions. In 43 cases rupture or tubal abortion had occurred the gestation had been ended and the products walled in but in the other 29 cases no rupture had occurred. However all the cases had one factor in common that is there was neither recent nor fresh blood in the pelvis in any case. In approximately three fourths of these cases of unruptured pregnancies or pregnancies with walled in blood or fetal products there was no decided increase in temperature pulse respiration or polymorphonuclear leucocyte count

The findings at operation—Group B (1000 to 6000)  
Leucocyte Count

	Percent	Fresh
5 Unruptured with blood		9.0
3 Tubal abortions with large amount of free blood and clots		
8 Ruptured fluid blood and clots		
9 Ruptured walled in with large number of clots		90.9
55		99.9

Summary Group B is the tubal abortion type. In nearly 91 per cent there were old fluid blood or clots in large amount in the pelvis. Only 5 cases were unruptured and showed no fresh blood. Each 1 of the 5 cases had a low total leucocyte count (10000 to 11000) showing the relation to Group A. Only 9 cases were walled in. Approximately three fourths of the cases had no increase in temperature pulse or respiration. The polymorphonuclear leucocyte count however had risen from 20 to 50 per cent

The findings at operation (in detail)—Group C (leucocyte count 600 to 3635) 3 cases

Cases	P	t	In mptl tubal bot on
1	6200	88	Tubal abo t —old blood and act e bl ding
2	6350	8	Partial ruptu e—act e bleeding a d l ts
3	18500	96	Tub l bortion—i mplete—act e bleed ng
4	2080	9	T b l bortion—ncompte—bleed g R ptu d fr sh blood in large amounts
5	2400	9	R pt d—ery l rge amo t f fr h blood
6	200	0	R pt ed—fl tu ting tum m
7	2350	83	I ruptured—v ry l g amount f f e blood
8	400	8	Ruptured horn of ut rus—fetus floatin n fre blood
9	9000	8	Ruptu ed—f ee blood—4 mos fetus in p l
	9600	86	R ptu ed—n mero s l t
	7000	9	Rupt d—old clots and old fl id blood
	500	0	R ptu ed—th e p t f blood
3	200	04	O pant fresh blood old clot fill g p l s
4	7800	94	R ptu ed—f rg m nt lots and fl id blood
5	9000	84	Ruptu d—l rg l t d bloody flu l
6	6400	84	R pt ed—free blood
7	3030	94	Isthmic rupt e—a ti bl d g r mo s amount f e sh blood
8	9000	8	R pt d—old blood lot —f tu sac
9	400	90	T b l ab r t n—fresh blood and old fl d l ts
0	500	9	Rupt red—p b bly d y bd m l prem ncy
	100	9	R pt d—f h blood a d lots
	0900	80	N r t e cl t n t b rupt d
3	26000	9	St mp f t be (p egn nt) rupt r d nd bdom p l t y fill d n th fl d blood d l t

**Summary** Group C represents the recent rupture type. Operation proved that in 19 of the 23 cases rupture *had recently occurred* and that active bleeding was going on in all of the four cases which were unruptured.

In 23 case 100 per cent rupture or incomplete tubal abortion with active bleeding occurred. Blood was found in very large amounts in the abdominal cavity in most of the cases.

In 3 cases a fetus was found 1 case was a secondary abdominal pregnancy. In 1 case the stump of a tube had been the site of the pregnancy and had ruptured and in another case the horn of the uterus was ruptured.

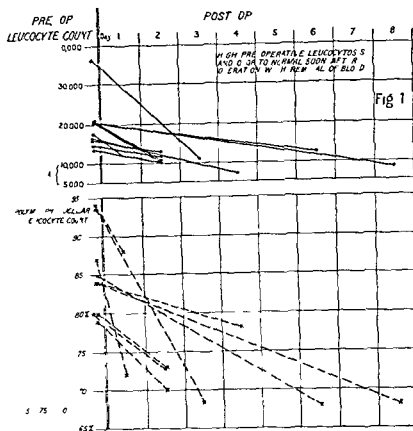
The temperature showed hardly any variation from that in Groups A and B. The pulse was increased in 56.5 per cent of the cases.

the respiration in 60.8 per cent. The total leucocyte count was increased 6000 to 26350 the polymorphonuclear count was above normal in every case and reached 90 per cent or over in 11 cases.

To consider briefly the chief diagnostic points in the tables made for comparison of the three groups it is evident that the temperature in these 150 cases was not greatly altered or lowered from the normal. The highest temperature in any case *before operation was 101.4 degrees F* and a subnormal temperature was present in only a small percentage of Groups A and B and in only 16.6 per cent in Group C.

The pulse was over 110 in only 8 per cent of the cases until we reach Group C. In this group (C) 56.5 per cent of the patients had a more rapid pulse rate and 60.8 per cent had a high increase in respiration. As the comparison table shows the polymorphonuclear leucocyte count made a definite increase from 19.4 per cent in Group A to 50.9 per cent in Group B and then to 100 per cent in Group C. While these groups were taken rather arbitrarily it was because 10000 is the upper limit considered normal. Clinically the cases seemed to divide themselves at a leucocyte count of approximately 16000 with the subacute on the one hand and the very acute on the other. The very acute cases come to the hospital with a severe degree of shock or in collapse. Group A (4500 to 10000) is the unruptured or walled in class and Group B (10000 to 16000) is the old tubal abortion type or the cases with ruptured tube but not a recent rupture and old fluid blood or clots present in very large amounts. Group C (16000 to 36350) is the class with recent rupture the patient being still in a very critical condition with free blood or active bleeding or an enormous amount of blood in the abdomen.

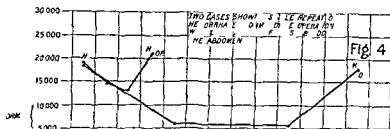
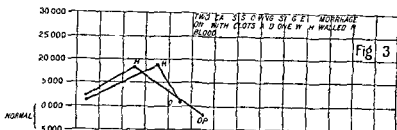
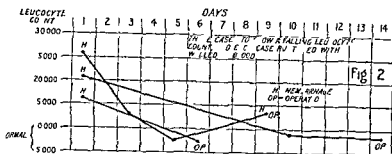
The polymorphonuclear leucocyte count was found increased in proportion to the amount of fresh blood in the peritoneal cavity and it is here that the leucocyte count seems to be of most diagnostic value. The blood may of course originate somewhere other than in a tubal pregnancy. A ruptured corpus luteum or hamatosalpinx or any



bleeding vessel would give the same white and polymorphonuclear leucocyte count when the blood is thrown into the peritoneal cavity. But in ectopic gestation the bleeding comes at intervals allowing an absorption or walling in and a drop in the leucocyte count is usually seen soon after admission to the hospital. When the blood is removed from the abdomen at the time of operation a previously high pre-operative count would drop quickly to normal as can be demonstrated by several cases as shown in Figure 1. In this chart are shown the high leucocyte counts of several patients on admission to the hospital with the average leucocyte curve and post-operative drop to normal shortly after operation and the removal of blood from the abdomen. We believe that the drop in the leucocyte count occurs when the fresh blood is absorbed or walled in and Figure 2 will show the high leucocyte count and its sub-

sequent drop in cases of ruptured tubal pregnancy with walling in of the blood and clot as proved by the operation done several days later. Figure 3 shows 2 cases in which there was a sudden rise in the white count after entrance to the hospital. Operation in 1 case the day following the hemorrhage revealed many clots in the pelvis not walled in and operation delayed for a few days in the second case showed a walled in mass consisting of fluid blood and clots. Figure 4 shows 2 cases with sudden rise in the leucocyte count and immediate operation. In each case the abdomen was full of fresh blood and clots. Figure 5 shows 3 cases with several hemorrhages and subsequent operation. Figure 6 is a composite picture of the leucocyte count and the temperature curve of the 10 cases just described. A fluctuating leucocyte count and a uniformly low temperature has characterized the whole series of



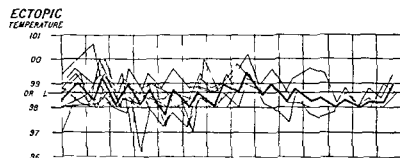
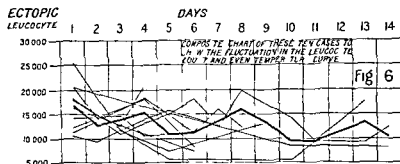


cases when patients have been in the hospital long enough to have had several white cell counts taken and when active bleeding has been going on. For comparison and differential diagnosis the lower half of this chart shows the more uniformly high leucocyte count and the picket fence temperature curve of 10 cases of tubo-ovarian abscess.

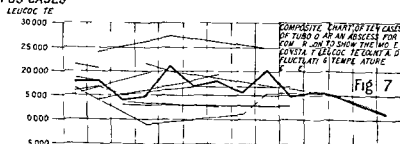
I was interested then to find what practical diagnostic value such a study has if any and Figure 7 shows the total white and poly-

morphonuclear leucocyte count and the temperature pulse respiration and blood pressure in cases of ruptured pregnancy with hemorrhage into the peritoneal cavity. The counts were repeated just before operation and the temperature pulse and respiration taken again at this time.

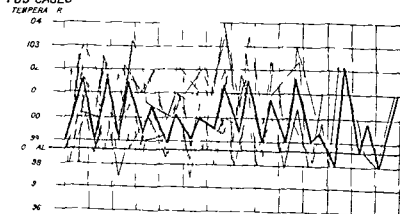
The comparative value of the temperature pulse respiration and blood pressure and the total leucocyte and polymorphonuclear leucocyte counts in ruptured pregnancy and



**PUS CASES**



**PUS CASES**





## CASE 4 No 33664

2-3	3 606 oo	red blls	P	t
	8 100 l	ucocy		60 haemogl b
	co t			84 polym rph ucl
2-	90	leucocyt		35 85 bl od p
				8 polymorph l rs
3 4	m	8 l acyt		76 polym rph l rs
		ou t		
2-5 4 9	p m 3 58	ed ll		5 h mogl b
		80 l ucocy		89 polymorph l
		ca		5 8 blood ptes
Operat	8 p m	Tub l abort		ery l rre am nt
fr sh blood				

2-6-4	3 48	d ll	P	t
	oo l uc y			6 h mogl b
				7 polymorph ucl rs

## SUMMARY OF THE 150 CASES OF ECTOPIC GESTATION STUDIED AT THE WOMAN'S HOSPITAL

1 In ectopic gestation the leucocyte count fluctuates according to the amount of fresh blood being thrown into the peritoneal cavity and the rate of absorption

2 The leucocyte count tends to drop quickly to normal as the blood in the peritoneal cavity is absorbed or walled in 48 per cent of 150 cases of ectopic gestation had a normal leucocyte count before operation was performed

3 The leucocyte count was normal in 29 cases of unruptured tubal pregnancy in which there was no free blood and in 43 cases of ruptured pregnancy in which the blood was walled in

4 The leucocyte count was an index in 150 cases to the amount of free blood in the peritoneal cavity and the polymorphonuclear leucocyte count was increased markedly only in cases having fresh blood in the pelvis and increased in direct proportion to the amount of recent blood found at the time of operation

5 The fluctuating leucocyte count together with the moderate elevation of temperature differentiates ectopic gestation from a purulent salpingitis with its more uniformly high leucocyte count and fluctuating temperature

6 In cases of rupture of tubal pregnancy the steadily rising leucocyte count indicates active bleeding before the fall in the number of red cells or haemoglobin gives warning of the condition

7 The leucocyte count to be of diagnostic value must be taken at least daily and in critical cases even hourly and used in conjunction with the history and clinical findings in the case

DUODENAL ULCER AS A COMPLICATION OF PULMONARY TUBERCULOSIS<sup>1</sup>

By JAMES R. LISA, M.D., ALBANY, N. Y.

GASTRIC disturbances are of such frequent occurrence during the course of pulmonary tuberculosis that a question naturally arises as to whether such disturbances have a true anatomical basis and if so just how often duodenal ulcer is present in such cases.

It is not ordinarily considered that duodenal ulcer is frequent during the course of phthisis. The extensive literature on ulcer scarcely mentions its relation to pulmonary tuberculosis and the literature on tuberculosis touches the subject very sparingly.

In a study of duodenal lesions in a large series of general autopsies performed at Guy's Hospital, Perry and Shaw (1) found only 25 cases of duodenal ulcer associated with pulmonary tuberculosis. In 11 of these cases the ulcers were tuberculous in type and in the remaining 14 non tuberculous. Of the non tuberculous group 1 ulcer was healed and 3 had perforated causing death by acute general suppurative peritonitis. The total number of tuberculosis cases in which autopsy was performed was not stated. Truer (2) reported 1 case of simple ulcer of the first portion of the duodenum with a healed pulmonary lesion. Krause (3) had 1 case of simple duodenal ulcer which had perforated and caused death. Claude's (4) case showed 7 non tuberculous ulcers. West's (5) case had simple ulcers 1 perforated. Of Monahan's (6) 2 cases 1 (No. 26) had 3 tuberculous ulcers, the other (No. 305) a single ulcer. Schwart (7) found 3 cases of duodenal ulcer in 15 autopsies all presumably being tuberculous in character. Of the reports quoted Schwart's alone states the total number of cases of tuberculosis.

In an effort to procure additional information bearing on the relation of duodenal ulcer to pulmonary tuberculosis the writer has reviewed two series of autopsies performed by him at the Metropolitan Hospital, New York City, covering a period of 4 years. One of the series consists of 257 autopsies on cases of pul-

monary tuberculosis including cases in which the tuberculosis was primary in other systems but also showing pulmonary involvement and for comparison another series of autopsies numbering 209 cases which showed no tuberculosis.

The following cases with duodenal ulcers are taken from the first series.

CASE 1. J. D. C. white male South American age 20 laborer had been ill 10 months. There was no marked gastric disturbance. Autopsy. In the first part of the duodenum was a small round ulcer with a pinpoint perforation. The surrounding serosa was covered with a fibrinous exudate. The tuberculosis was the direct cause of death, the peritonitis was very early and limited in extent.

CASE 2. H. A. white male South American age 27 seaman gave length of illness as 2½ years. The chief complaint throughout the disease was chest and epigastriac pain. Autopsy (Fig. 1). Seen shallow round antrogastric ulcers of various sizes with smooth edges and black bases involved the duodenum from the pylorus to the ampulla. Microscopic examination (Fig. 2). The base is formed by the muscular coats and covered by a thin necrotic layer. The edges are in the cellulitis stage of the base is very mod. and consists of lymphocytes and endothelial cells.

CASE 3. D. E. black female Porto Rican age 35 housewife gave the length of illness as 3 years. There were no marked gastric symptoms. Autopsy. In the first part of the duodenum on the posterior wall was a round ulcer 1½ cm. in diameter and slightly irregular and center depressed.

CASE 4. A. G. black female a British West Indian age 25 was a housewife. The total length of illness was 3 years. The chief complaint was epigastriac pain during the early morning and late evening and occasional ill in the course of the day. Autopsy. Just below the pylorus was a large rough circular depression on the posterior wall. The ulcer face was 6 mm. Near the ulcer was a second similar character which had perforated at its edges. The smooth area of the ulcer was covered by a necrotic layer of inflammatory reaction. The perforation was microscopic examination. The ulcer was slightly elevated. The base was formed by the muscular coats and was covered by a narrow layer of necrotic tissue. The cellular reaction moderate and consisted of endothelial leucocytes, few polymorphonuclear cells and lymphocytes. The blood vessels were slightly dilated and contained an



Fig. 2. Case 2 (Low power) Section through duodenum showing the necrotic base of the ulcer with slight tendency to undermining of the edge and the moderate cellular infiltration.

Fig. 3. Case 2 (High power) Section through duodenum showing the necrotic base of the ulcer with slight tendency to undermining of the edge and the moderate cellular infiltration.

increased number of polymorphonuclear leucocytes. The arterial walls were normal.

CASE 5. G. K. black female British West Indian age 34 was a chambermaid. The length of illness was 5 months. There were no marked gastric symptoms. Autopsy. On the posterior wall of the duodenum 0.5 centimeters from the pylorus was an irregular ulcer with thickened raised rather soft slightly undermined edges and irregular depressed base. Microscopic examination. The base of the ulcer was formed by the muscular coats and was covered by a thin even non-rotic layer containing several small clumps of coagulated fairly well down toward the muscle. The edges were sloping as a rule and showed only slight tendency to undermining. The cellular infiltration consisting of endothelial leucocytes lymphocytes plasma cells and a very occasional polymorphonuclear leucocyte was fairly dense and involved the muscular coats. The epithelium at the edges was slightly hyperplastic. The small arteries in the base and edges presented distantly thickened walls.

CASE 6. J. L. white male Russian age 36 was a laborer. The duration of illness was 7 months. Histology unobtainable. Autopsy. The first part of the duodenum had a large circular ulcer the size of a silver half dollar 0.5 centimeters below the pyloric ring. The base was fairly smooth and adherent to the pancreas. The edges were heaped up irregular nodular fairly firm. In one portion was a distinctly yellowish grey pea sized caseous area. This case also had multiple gastric ulcers. Microscopic examination. In area A (Fig. 3) was a distinct focal caseation necrosis involving the mucosa submucosa and muscular layers separated from the pancreas by thickened connective tissue. This area was surrounded by a zone of small lymphocytes and endothelial cells. The remainder of the ulcer presented a different picture. The edge was hyperplastic and even. The base was formed by the muscular layers. The cell infiltration was fairly heavy and consisted of endothelial and lymphocytic cells. The vessels were normal.

CASE 7. L. K. was a Chinaman male age 30 occupation unknown. The duration of illness was 5 years. Autopsy was unobtainable. Autopsy. In the first part of the duodenum were four irregular ulcers with jet black smooth bases and slightly raised fairly firm edges. Microscopic examination (Fig. 4). The base was formed by the muscular layers. The edges were smooth and slightly sloping. The cellular reaction was very slight. The arteries were negative.

CASE 8. H. F. was a white male a South American age 20 occupation unknown. The duration of illness was 3 weeks. There were no marked gastric symptoms. Autopsy (Fig. 5). In the first part of the duodenum were two small shallow clean ulcers with sloping edges and black bases. Microscopic examination. The edge and base were even. The base rested on the muscular coats and was covered by a narrow

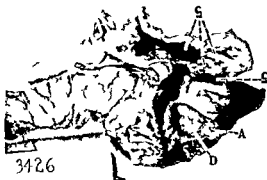


Fig 3 Case 6 Showing the large duodenal ulcer (D) with the biliary tract (G) and the gastric vessels (G).

necrotic layer. The cellular reaction was very scanty, consisting only of a very occasional endothelial leucocyte. The submucosa had a moderate fibrosis. Its small arteries showed some fibrosis of the walls.

CASE 9. L. G. black female, British West Indian, age 33, was a housewife. The duration of illness was unknown. There were no marked gastric symptoms. Autopsy. In the first part of the duodenum below the pyloric ring were two irregular shallow ulcers. The bases were smooth, the edges even. Microscopic examination. The edges were sloping. The base was formed by the muscle, was slightly irregular and covered by a necrotic layer. The cellular infiltration was moderate and consisted of lymphocytes, endothelial cells and a few polymorphonuclear leucocytes. The vessels were negative.

By comparison in the second series embracing 209 cases showing no tuberculosis, but 4 cases of duodenal ulcer were found. The associated lesions in these instances were chronic glomerulonephritis, chronic diffuse nephritis and acute purulent pericarditis, broncho pneumonia, and syphilis of the heart and aorta. In the last case the ulcer had perforated, death being due to acute general suppurative peritonitis.

#### DISCUSSION

A history of gastric disturbances was elicited in but 3 of the 9 ulcer cases reported. The anamnesis was a routine one and no special effort was made to establish a diagnosis of ulcer.

All of the ulcers were located in the upper part of the duodenum, between the pylorus and the ampulla of Vater. All were simple and not tuberculous in character. Five of the 9 cases showed multiple ulcers. One case only



Fig 4 Case 7 (L. G. black female) Section through the ulcer showing the necrotic layer (D) and the biliary tract (G).

Case 6 had an added tuberculous involvement; this was evidently implanted on a pre-existing simple ulcer and involved only a very small portion of the ulcer itself.



Fig 5 Case 8. The ulcer (D) is regular, shallow, and is delimited by the pylorus.

The pulmonary tuberculosis is in all cases with one exception. Case 8 was of an extremely

chronic form In Cases 5 and 6 which clinically had histories covering only 3 and 7 months respectively the lung lesion appeared to be of much longer duration One case only Case 8 showed an acute pneumonic form of tuberculosis It was of interest to note that the cases of pulmonary tuberculosis showed a marked tendency to secondary infection a factor possibly being the contributing cause of ulcer on an embolic basis

# CONCLUSIONS

While the total number of autopsies (466) upon which this report is based is hardly sufficient to warrant positive final conclusions the following deductions bearing on the relation of duodenal ulcer to chronic pulmonary tuberculosis may be drawn from this review of cases

- 1 Duodenal ulcer is found at autopsy more

frequently with pulmonary tuberculosis than with any other disease

The ulcer is usually non tuberculous in character

3 Pulmonary tuberculosis associated with duodenal ulcer is of usually chronic form

4 The age of most frequent occurrence of ulcer is 25 to 35 years

5 Careful gastric histories in cases of pulmonary tuberculosis checked by radiological findings will probably reveal duodenal ulcer in a greater number of cases than is now diagnosed

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# TOTAL GASTRECTOMY

## WITH REPORT OF A CASE OF LINITIS PLASTICA TREATED BY A COMPLETE EXCISION OF THE STOMACH

By MONT R. REID, M.D., CINCINNATI, OHIO

THE idea of total gastrectomy apparently originated with Czerny who in 1875 suggested that certain lesions of the stomach might best be treated by the complete removal of this organ In 1880 Albert practiced the operation of total gastrectomy upon human cadavers The first attempt to perform this operation upon the living human being was made by Conner in 1883 Although his patient did not survive the operation it is pleasing to learn that in the literature of gastric surgery he is rightfully honored as the first surgeon to have the courage to follow his conviction that certain lesions are best treated by the total extirpation of the stomach This was in the early days of gastric surgery when even the operation of partial gastrectomy (first performed by Pean in 1870 and first successfully by Billroth in 1881) was exceedingly rarely performed and its value much ques-

tioned It is therefore not surprising that 14 years elapsed before another case of total gastrectomy was reported<sup>1</sup> Schlatter in 1897 reported the second case His was the first successful case the patient having lived for 14 months after the operation Soon after this MacDonald Brigham Brooks Richardson and others reported successful cases

Charles H. Frazier (1900) in a critical summary of the literature on the surgery of the stomach collected 9 cases of total gastrectomy By 1906 Herbert J. Patterson found that the number of cases had increased to 27 In 1911 Trunkler collected and carefully tabulated 26 cases of total gastrectomy giving the late results He evidently failed to find in the literature a few cases previously reported by Patterson The next summary of reported

<sup>1</sup>In Conner's original report (1883) the total gastrectomy had been performed in his attempt to cure these cases in the literature.





Fig 1. Roentgen gram film of the stomach. The pyloric region is dilated. The stomach is filled with food. The pyloric region is dilated. The stomach is filled with food. The pyloric region is dilated. The stomach is filled with food.

cases appeared in 1921 by Kreuter who collected 44 cases. Rost (1923) says that some 40 cases have been reported but that the number is probably a little larger. It has been stated that the number is more accurately about 50 at the present time. The rarity of the operation and the surprisingly good results that follow it prompt me to report the following case:

C. M., a white woman, age 51 years, was admitted to the Cincinnati General Hospital November 8, 1924, with the complaint of stomach trouble. Our studies revealed a small fundus and a long anterior pyloric region with an almost complete obstruction (Fig. 1). The very long obstruction together with the small capacity of the stomach made us feel that the lesion of the stomach was very extensive if indeed it did not involve the entire stomach. Contrasted with this extensive lesion was the patient's general condition which except for lethargy and emaciation was good. She had lost 45 pounds in weight. The blood examination revealed 5,500 white cells, 500,000 red cells, 85 percent haemoglobin, a normal differential count and a negative Wassermann test. One hour after the ingestion of an Ewald test meal 30 cubic centimeters of fluid were recovered from the stomach in which the free hydrochloric acid was 2 percent and the total acid 38 percent. In the specimen of vomitus the acidity percent was the same and there was considerable blood. Examination of the urine and faeces revealed nothing abnormal. So far as we could judge by physical examination and

by the use of X-rays there were no metastases from a possible malignant growth of the stomach.

The symptoms of stomach trouble, mainly belching, a sour stomach and vomiting had been present for a little longer than a year. For the past 2 months she had vomited practically all food and fluids—the vomiting occurring almost immediately after the taking of food.

Although the X-ray picture made us doubt that any relief could be obtained by an operation it was thought best to make an exploratory incision into the abdomen. To prepare the patient for the operation several thousand cubic centimeters of salt solution were given subcutaneously during the 2 days prior to operation.

Operation by the author November 17, 1924. Light anesthesia was used. The stomach was found to be very small and extremely hard and leathery throughout its entire extent. Near the pylorus the consistency of the lesion was almost cartilaginous. There was no gross evidence of a cystic lesion of the pathological process outside of the stomach. The stomach was so nearly reduced to a small hard fibrous tub that it was evidently impossible to give relief either by a gastroenterostomy or a partial resection of the stomach. I therefore decided to attempt not only to relieve the obstruction but to cure the condition by removing the entire stomach. To get a better exposure the abdominal

incision was divided transversely from the right rectus incision to the left costal margin. The entire stomach was then removed. This was not difficult for it was not adherent to the pancreas. The adhesions between the stomach and pleen were very firm. Restoration of the continuity of the alimentary tract as illustrated in Figure 2, especially the end-to-end anastomosis between the distal end of the divided jejunum and the esophagus, was however quite difficult because of the depth of the wound and the absence of a structure varying on the posterior wall of the esophagus. Both the esophagojejunal and jejunojejunal anastomoses were made with interrupted half-tied mattress sutures of silk. The blind end of the duodenum was inverted by suturing its ends (Fig. 3). The time required to perform the operation was 3 hours. No blood however was lost and at the completion of the operation we found our patient with a pulse of 90 and in good condition.

Throughout her postoperative period the general condition was good, the temperature remained normal and the pulse rate between 80 and 90. Forty days after operation nothing was given by mouth but fluids and some nourishment were given both subcutaneously and by rectum. On the sixth day a small amount of food was given by mouth every hour. On the eighth day a large albumen and peptonized food in the amount were begun. On the tenth day she began taking after when she sat up but was cautioned to drink slowly and her food the form of peptonized milk, cream, orange juice with tea etc. was increased to 750 calories. Within a month a general soft diet

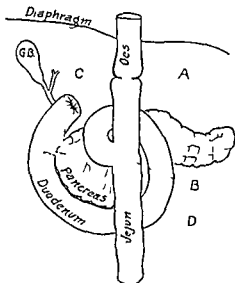


Fig 3 The entire stomach (author's case). Note its size and thickened wall. The mucosa is atrophied in the pylorus; the rest of the stomach is thrown into large folds and apparently hypertrophied. The tape is through the center of the stomach.

The greatest anxiety during her convalescence was occasioned by the development of a severe stomatitis on the eighth day. This was a serious complication for almost 10 days and it was nearly 4 weeks before the mouth was entirely well. The recovery from the stomatitis was due, I think, to the almost constant attention of the residents, internes, and nurses who carefully cleansed and oiled the mouth every few hours. It is doubtful if the many things used, such as potassium chlorate, hydrochloric acid, sodium bicarbonate, compound tincture of myrrh, etc., were as instrumental in her recovery as was the careful mechanical cleansing of the mouth. In many of the reported cases of total gastrectomy stomatitis has been a serious and occasionally a fatal complication.

A study of the stomach revealed a diffuse sclerotic type of scirrhus carcinoma which involved all of the stomach except a small portion of the fundus. The mucosa thrown into large folds and rather redundant in appearance was everywhere intact except in the pyloric region where there had occurred a marked atrophy of the mucosa due apparently to pressure from the constricting muscular walls. The wall of the pyloric portion of the stomach was very firm and fibrous; the remaining wall was distinctly leathery in consistency. Grossly the process was typical of linitis plastica or a leather bottle stomach (Fig 3). Histologically the pathological change is a diffuse scirrhus carcinoma. The cancer cells are better preserved and rather more numerous than one usually observes in typical cases of linitis plastica (Figs 4 and 5). Indeed in some cases the fibrotic process is so marked that it may be difficult to recognize or definitely to find any cancer cells.

Judging from the number of cancer cells and their good state of preservation we are inclined to believe that in our case the pathological change has developed comparatively rapidly and that the prognosis is consequently not so good as in the more fibrous types of linitis plastica. However the removed lymph glands do not show any evidences of metastases.

Fig 4 Diagram to illustrate the author's method of performing the alimentary tract after total gastrectomy. A (Esophagus) joined to stomach B (Jejunum) joined to stomach C (Duodenum) joined to stomach D (Blind end of duodenum). Note that the stomach is made of an inguinal hernia and that the blind gut from filling with food D (Blind end of duodenum) is removed.

in small amounts supplemented by intermediate nourishment of egg-nogs, candy, ice cream, etc., was permitted.

She has continued to take a soft diet and has gained in weight. She has not vomited and has recovered her health and strength to such an extent that she is doing her own housework. The only discomfort she experiences now is a sensation of fullness after eating small amounts of food. She is however gradually taking more food at a time.

The only medication consisted of dilute hydrochloric acid, minims 10, and pepsin solution, 1 cubic centimeter, three times a day. Since leaving the hospital the patient has continued to take the hydrochloric acid but has discontinued the use of the pepsin solution.

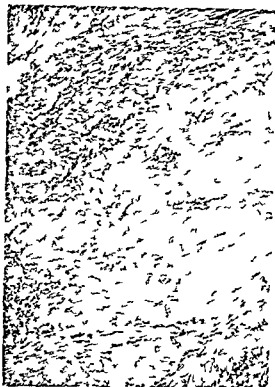


FIG. 4. Photomicrograph (low power) of the stomach wall showing gastric antral fibroblasts and cells.

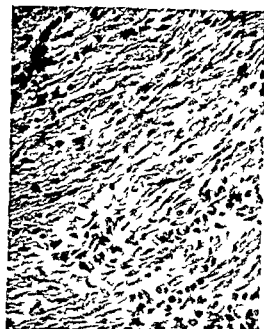


FIG. 5. Photomicrograph (high power) of the cellular structure of the stomach wall.

# REMARKS

I review to Schlatter's report of a successful total extirpation of the stomach there had been considerable argument as to whether or not a portion of the stomach was essential to life. Such arguments ceased after his report.

With the demonstration that total extirpation of the stomach was compatible with life, attention became focused upon the possible digestive and mechanical readjustments following the operation. Studies along these lines have been reported by De Filippi, Cohn, Trunkler, and others. One of the main functions of the stomach is to act as a reservoir for food which can be released gradually and in small amounts into the duodenum. Patients usually compensate for this loss of function by taking frequent small quantities of food. However, several observers, especially Cohn, have noted that the lower esophagus and duodenum (or jejunum) dilate following a

total gastrectomy, and that consequently the capacity for food gradually increases. By some authors this dilatation has been ascribed to the destruction of the vagus fibers at the time of operation. In our case, now 4 months after the operation, no dilatation of either the esophagus or jejunum is demonstrable. Yet the patient is able to eat, though rather slowly, three average meals a day without developing a marked sensation of pressure in the abdomen. The mechanical or macerating effect of the stomach upon food must be compensated for by a proper preparation of the food. It has been shown also that the secretory functions of the stomach can be assumed by other parts of the digestive apparatus. For instance, the function of pepsin is replaced by trypsin, and the other less important enzymes such as rennin are present in the pancreatic and intestinal juices. The antiseptic action of hydrochloric acid is partially assumed by the bile. Though many patients have been given hydrochloric acid after a total gastrectomy, it is doubtful if such therapy is either necessary or advisable. Many patients with a total



FIGURE 6. Remnant of the stomach (Esophago-jejunal anastomosis).

anacidity of the stomach get along without any discomfort and not a few gastroenterologists consider it unwise always to prescribe hydrochloric acid when such a condition is discovered. The slight resorptive power of the stomach is very readily assumed by the intestines.

Among the effects of a total gastrectomy constipation has been noted. This was observed both by Unger and Schlatter and Cohn suggested that it was the result of cutting vagus fibers. In our case constipation which was present before the operation has disappeared and bismuth passes normally through the small intestines into the large. Explanation for the stomatitis after a total gastrectomy is not so far as I can learn known. Perhaps some reflex effect upon the salivary glands may be responsible for it. Certainly it was a serious and annoying post-operative complication in our case.

The operations of total gastrectomy have all been performed for carcinomata. Certainly the type of growth most favorable for this

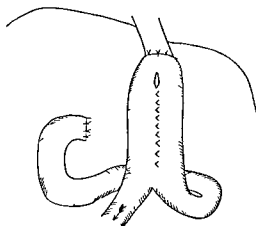


FIGURE 7. Diagram of the method for reestablishing the alimentary tract after total gastrectomy. The enterostomy is between the jejunocolic anastomosis and the large reservoir for food.

operation is the slowly growing carcinoma without any or at least extensive metastases. The most ideal lesion demanding a total extirpation of the stomach is the sclerosing scirrhus carcinoma known as linitis plastica or leather bottle stomach. In most clinics this condition is regarded as inoperable inasmuch as relief cannot be obtained by any of the ordinary procedures such as a gastroenterostomy or a partial resection of the stomach. The condition develops slowly symptoms usually being present for a year or longer and the result is almost always death from starvation. Metastases rarely occur. The diagnosis should be suspected whenever a patient gives a long history of stomach trouble has a relatively normal gastric juice and the X ray shows a tubular stomach with a very small smooth lumen. In addition anemia is not usually present and the patient's general condition is good except for the loss of weight. I mention these points in diagnosis for patients presenting such symptoms and physical findings especially the characteristic X ray picture should come under the care of surgeons who have the ability and courage to perform total gastrectomies.

In Kreuter's study of 44 cases of total gastrectomy the esophagus was anastomosed to the jejunum 20 times and to the duodenum 13 times. In 5 instances the type of operation

was not stated while in 6 cases a makeshift operation such as a duodenal or jejunal fistula was performed. In the more recent cases a decided preference has been shown for the cesophagojejunal anastomosis. Viktor Hoffmann has recently published a method of re-constructing a reservoir out of the jejunum following an operation in which the stomach is totally removed (Fig 7).

# RESULTS

Patterson found that 17 per cent of the patients who recovered from the operation of total gastrectomy were alive and well 5 years later. At the time of his report MacDonald's patient had been well and working on a farm for 7 years and Brooks' patient had been living 8 years. In this author's study the results of total gastrectomy were better than those of subtotal gastrectomy. The operative mortality of total gastrectomy was found by Frazier to be 33 per cent and by Patterson 36 per cent.

Unless many unsuccessful cases have not been reported these statistics make the operation of total gastrectomy feasible and indicated in properly selected cases.

In view of the enormous increase in surgical work upon the stomach and the refinement of surgical technique it is rather surprising to learn that the number of reported cases of

total gastrectomy has not been as great since 1906 as it was in the 10 years prior to that time.

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# DEPARTMENT OF TECHNIQUE

## THE TECHNIQUE OF TONSIL OPERATION

By ELLIOTT H. HUTCHINS, M.D., F.A.C.S., BALTIMORE, MARYLAND

ONE of the chief functions of surgery is the management of wounded vessels, the avoidance of hæmorrhage. The only weapon with which the unconscious patient can immediately retaliate upon the incompetent surgeon is hæmorrhage. If he bleeds to death, it may be presumed that the surgeon is to blame, whereas if he dies of pneumonia, peritonitis, or other infection, or from an unphysiological performance, the surgeon's incompetence may not be so evident.

As a student I found it difficult to reconcile the above dictum of the late William S. Halsted with what I saw in those days in the laryngological clinic. I could not understand the reason for such rigid hæmostasis in operations upon the thyroid or appendix or for hernia when so little effort was made to control bleeding in operations upon the nose and throat. Indeed I was tempted to conclude that the question of paramount importance was not the amount of blood that was lost but the special field through which the loss occurred.

Since that time, however, surgery of the throat has made rapid progress. Observation convinces me that in practically all hospitals the amount of good work is increasing and that of an inferior type decreasing. Nevertheless the rate of morbidity and operative mortality, mostly unrecorded if known, would probably convince one of the need of further discussion in this special field.

The writer is not a throat specialist but has had thrust upon him a relatively large number of throat cases along with other work in a rural hospital where versatility is a necessity rather than a choice. In this work certain obstacles occasioned by environment stimulated special interest in the subject with the object that any untoward result occasioned by the handicap might be anticipated and thereby obviated.

Were it possible to tabulate accurately the number of deaths resulting from septicæmia, pulmonary infections, and various other metastatic conditions occurring in patients from whose

throats the first line of defense, the tonsil, had been removed, and to say what the result would have been had the tonsil been able to engage the invading organisms for a time sufficient to enable the body to react, I believe the balance of evidence would be so decidedly in favor of the importance of their role in the body economy that there would be a decided tendency to leave the tonsils in very young children undisturbed until their fighting force is clearly on the wane. In other words, I feel that there are too many children under the age of 6 from whose throats tonsils are being removed before their defensive power has been used up or before the tonsils have become a menace to the body from infection and absorption. Of course many exceptions to this rule are conceded.

The choice of time to operate following an acute infection would seem to deserve more consideration than it now receives. The writer not long since saw a patient suffering from painful, acutely inflamed joints preparing to go to the hospital the next day to have his tonsils removed. The reason for objection is so obvious that it needs only to be mentioned. Next to the proper diagnosis and selection of time for the operation, discussion of the management of such cases may be productive of benefit.

As has been insisted upon by many authors, tonsillectomy as a surgical procedure is too lightly regarded. I believe it to be an incontrovertible fact that the mortality following throat operations is higher than that following any other so-called clean case or cases in which there is a choice of time to operate.

I believe also that the morbidity, including in complete removal of lingual and faucial tonsils and adenoiditis, together with the damage to pillars and other adjacent tissues, is greater than obtains in any other operation upon the body except perhaps operations for abdominal adhesions.

The high operative mortality will undoubtedly be affected favorably when we accept and utilize the fact that the throat patient is about to un-

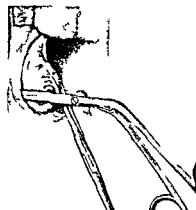


Fig 1



Fig 2



Fig 3

Fig 1 Position of patient's head of the table. The lingual artery is shown in position showing the straight line and the distance with space between the sufficient width of the bulging of the tonsil tissue between the teeth. The manner in which the tonsil is used with the distance of the width of the scissoring (the distance) in position to be inserted into the line of clamping but the distance is

pull after the membrane has been dissected out of the neck of the tonsil.

Fig 2 Dissection with the back of the blade of the scissor, the dissection is positioned to the lingual tonsil.

Fig 3 Scissor in line of cleavage after the dissection of the mucous membrane has been prolonged. The distance is exposed from below.

dergo an ordeal more exacting possibly during the operation and convalescence than awaits one who is to be operated upon for a recognized major condition. Is there any logical reason why a

throat patient should be deprived of routine preoperative investigation any more than another about to undergo a major operation? Rather would it seem that repeated infections which have

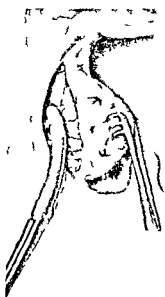


Fig 4

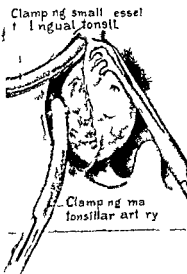


Fig 5



Fig 6

Fig 4 Tonsillar artery being clamped.  
Fig 5 Shows the position of the dissection of the artery and the lingual tonsil. The clamp applied to the small artery running through the lingual tonsil.

Fig 6 Shows the position of the dissection of the artery and the lingual tonsil. The clamp applied to the small artery running through the lingual tonsil.

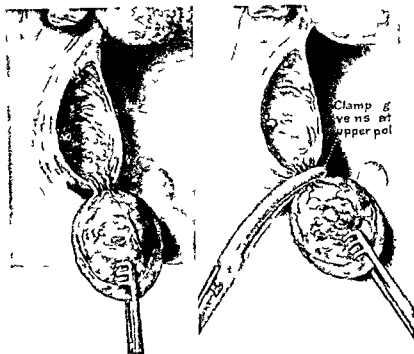


Fig 7 (left) Shows plexus of vessels at the upper pole of the faucial tonsil and the stumps of the arteries which have been divided and ligated  
 Fig 8 Kelly clamp grasping the large veins at the upper pole

damaged the tonsils sufficiently to justify their removal might also have damaged other organs

In no other operation would it seem more difficult to select the proper anæsthetic than in throat cases. Indictment may justly be made against both local and general anæsthesia if all cases are to be handled alike. Against local anæsthesia on the one hand stands the fact that death has followed the application of cocaine to the mucous membrane of the throat grievously often and while one cannot say that the accident is entirely due to the anæsthetic the strength of indictment is increased by the fact that the writer knows of cases too numerous in which death occurred before the operation had begun. On the other hand one is fortunate indeed who has occupied the field of throat surgery for any length of time if he has been spared the horror of discovering during convalescence in one of his tonsil cases a metastatic abscess in the chest. According to some thoracic surgeons notably Ambrose L. Lockwood of Toronto the burden of proof in this offense is decidedly upon general anæsthesia.

Both local and general anæsthesia have been tried by the writer and it is only fair to state that while tonsils may be removed very well

under local anæsthesia only exceptionally has it been as satisfactory as general anæsthesia. General anæsthesia with the Griffith Davis mouth gag in the hands of a specialist in anæsthesia in my experience leaves but little to be desired not only because the administration of the anæsthetic is easier but also because the operative field is exposed in a manner otherwise unsurpassed.

Before beginning a throat operation it would seem among other things that the operator should fully appreciate the following points:

It is impossible to eliminate the presence of organisms from the operative field. The bacterial flora of the mouth *prima facie* offers perhaps the worst operative environment of any part of the body. However in all probability the presence of the great number of organisms is compensated for in a measure by special resistance of the tissues in the surrounding vicinity. If infection is to be prevented this must be accomplished by adding to the general body resistance the benefits accruing from proper respect for the tissues of the throat through gentleness of manipulation adequate hæmorrhage the production of a minimal mass of tissue necrosis (consistent with rigid



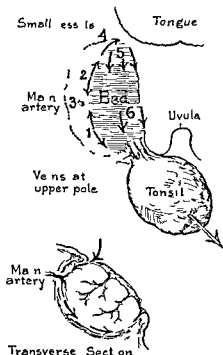


Fig. 9. Diagram showing the direction of the dissection and the order of procedure. To cut the vascular section of the tonsil and the probable location of the tonsillar artery.

hemostasis) The operator should clamp the arteries before dividing them instead of digging down into the tissues in order to catch a telescoped vessel which has been divided avoid the introduction of organisms into the depths of tissue on needles and lastly but of great importance he must be sure that he is capable of executing a rapid and clean ligation of the carotid if occasion should demand.

With these data in mind the writer has used for the past 10 years or more an operative procedure for removal of tonsil and adenoids that has been so satisfactory in practically all cases that it may be worth while to add it to the long list of methods now in use.

Under general anesthesia and by means of the Davy mouth gag adequate exposure without which proper surgical procedures are difficult if not impossible is obtained. This gag when carefully inserted overcomes the objection offered by many and may be so placed that no harm will result to the teeth or soft tissues (Fig. 1). The tonsil is seized with a tenaculum preferably one with several teeth rather long so that when dealing with friable tissues a large amount of

their framework may be lightly held within its grasp. The tonsil is then gently drawn upward and toward the midline until the upper end of the line of junction formed by the tonsil on one side and the anterior pillar on the other is brought clearly into view. With a pair of blunt scissors—not with a knife—the mucous membrane of the pillar is divided as closely as possible to the presenting surface of the tonsil. A point of cleavage between the pillar and tonsil is sought and the end of the scissors inserted into this cleavage. By gentle manipulation the scissors are worked into the depths care being used in their direction to follow the curvature of the capsule of the tonsil and special care not to puncture it.

After the scissors have been introduced sufficiently (Fig. 2) the blade are gently opened so as to bring about a blunt dissection with the backs of the blades aided by the leverage of the handles and pressure of the opposing blade. In this way the tonsillar artery is definitely outlined from above (Fig. 3). The incision through the mucous membrane only is then prolonged downward following the line of junction between the anterior pillar and tonsil to and including the lingual tonsil. Another point of cleavage between the pillar and tonsil is then found below the tonsillar artery and by blunt dissection similar to that above mentioned the vessel is isolated and exposed from below (Fig. 4). A long Kelly clamp is then applied to the artery before it is divided with the result that not only is bleeding reduced to a minimum but also tissue is conserved by avoiding the necessity of dipping the clamp down into it in an effort to catch a telescoped vessel which may cause destruction of a relatively large amount of tissue and possibly some very important structures. The artery is then divided the main arterial supply to the tonsil being thereby cut off before the network of veins has been opened. This procedure in a measure is analogous to the application of a tourniquet in the amputation of an extremity. The entire line of dissection clearly in view of the operator is carried down (Fig. 5) around the lower pole so as to include both the faucial and lingual tonsil. Usually it is necessary to clamp the small vessel running to the lingual tonsil but this is not always the case. The lingual tonsil (Fig. 6) is seized with a tenaculum or Ochsner clamp and by folding it upon itself is drawn forward and upward by blunt dissection a line of cleavage is found at the junction of the tonsil and posterior pillar. The dissection is then continued up the posterior pillar (Fig. 7) and the upper pole is approached numerous veins forming a network

come into view. If sufficiently formidable these are clamped before being divided (Fig. 8). The tonsil is removed and ligatures applied. Personally I have had but little difficulty in placing these ligatures without the use of a needle. I feel that it is better to have a mass of tissue which may be expected to necrose in the presence of infection within the grasp of the clamp and to have the ligature material on the surface rather than extending from the surface into the depths of the tissue. The partly buried ligatures plus rough handling of the tissues may be important factors in the development of metastatic abscess within the thorax.

Not only do I prefer to follow the anterior pillar down before disturbing the posterior out of respect for the blood supply and proper handling of this important factor but in addition I have found in the majority of cases that the anterior aspect of the tonsil unlike the posterior instead of being more or less constant is variable. At times it is so irregular that one may find lymphoid tissue apparently continuous with the tonsil bursting as it were through its bounds and crawling up over the anterior pillars more especially as the lower poles are approached.

There are cases in which the lines of cleavage are more imaginary than real, cases in which it is difficult to differentiate tissue, cases in which it is easy to leave tiny bits of lymphoid tissue difficult to discover at the time of operation but very easily seen a year later. In these difficult cases the method above described has nothing to lose by comparison with any other that I have used but for me at least is even preferable.

It is impossible to lay too much stress upon the importance of gentle sponging and the avoidance of unnecessary clamping and other damage

to tissues of the throat. The throat deserves the application of the principles of surgery as much as any other part of the body and probably needs them a great deal more.

A discussion of methods of removing tonsils would be incomplete indeed were it not also to include a few words concerning their next neighbor the adenoids.

The writer has long since learned that the amount of adenoid tissue capable of being safely removed with an adenoid curette is in most cases only a small percentage of the sum total. He is also convinced that except for mechanical reasons the portion removable with the curette is the least dangerous to health, that from the standpoint of infection and absorption the most dangerous portion is not the adenoid tissue accessible to the curette where drainage is more or less efficient but it is that large amount of adenoid tissue tucked away so to speak in the crannies and folds about and even upon the inferior turbinate bone and adjacent structures. This is perhaps the area of adenoid tissue inaccessible to medical applications as well as instruments in which infection flourishes and in which the pressure due to swelling becomes most damaging. In view of these facts one is inclined to feel that the laugh instead of being on the old doctor who used his finger nail to remove adenoids, if his finger were reasonably clean apparently might be on us. It has therefore been my practice to supplement the conventional use of the adenoid curette with my index finger with which I explore the posterior nasal cavity thoroughly, giving careful attention to the inferior turbinate bone. In my opinion at least the amount of tissue removed with this finger justifies this safe dependable and indispensable aid.

# BLOOD TRANSFUSION BY THE DIRECT SYRINGE-CANNULA NEEDLE METHOD ITS APPLICATION IN MAJOR SURGERY

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From the Surg. Services of Mich. Reese and Ch. g. Lying-in Hospital

**B**LOOD transfusions have been used for many years as a great aid in major surgery.

The majority of surgeons however have resorted to blood transfusions in major surgical procedures only when the patient is in very serious condition. This view of using this valuable aid only as a last resort is wrong. It should be used more as a prophylactic measure for poor operative risks. For 14 years I have used blood transfusion on the slightest provocation when there was any question about the risk of the patient and usually before operation with the result that a questionable risk was converted into one that was absolutely safe. Most men have used either the citrate method or some form of complicated apparatus or device for transfusion whereas we have used only a specially devised needle and an ordinary 100 cubic centimeter Luer syringe transferring the blood directly from donor to recipient.

Blood transfusion has been especially valuable in hæmorrhage of the newborn and in children especially in hæmorrhage from the intestinal tract and in the decompositions occurring in infancy in acute hæmorrhage from ulcers of the stomach and duodenum in acute and chronic hæmorrhages from the intestinal tract and in severe hæmorrhage due to injury.

Much has been written about the danger of transfusing too many times at short intervals but oftentimes when the clinician fails to recognize that the patient has lost 2 or more quart of blood the usual transfusion of 600 cubic centimeters is unsatisfactory because it does not replace the quantity of blood lost or restore the original blood pressure. In several cases of ulcer hæmorrhage so profuse that the patient was pulseless two transfusions were given by two different donor before operation and a third transfusion from a third donor after operation followed by complete recovery. In another case a man of almost giant stature who was completely exsanguinated was

given two transfusions before operation of 800 and 600 cubic centimeters respectively by two different donors a third transfusion of 600 cubic centimeters after the operation and within 12 hours a fourth transfusion of 600 cubic centimeters.

Frequently in chronic obstructive jaundice blood transfusion not only increases the blood pressure and decreases the toxicity but also promptly decreases the coagulation time to 2½ or 3 minutes.

Patients with anæmias secondary to chronic ulcers of the stomach and duodenum chronic ulcerative colitis carcinoma of the stomach duodenum colon and rectum may be undernourished emaciated and markedly dehydrated. Such patients are not immediate emergencies for operation. They are prepared for operation in the following manner. For 6 or 8 days they are given one pint of 5 per cent glucose solution twice daily plus 3 000 cubic centimeters of physiologic salt solution once daily followed by a 600 to 800 cubic centimeter blood transfusion just before operation. If the patient's condition is at all questionable after operation a second transfusion of about 600 cubic centimeters of blood should be given without hesitation. A patient who has been prepared in this manner or modification thereof will go back to bed from the operating room with a full pulse usually less than 100 with blood pressure ranging from 110 to 130—and if the blood pressure is at first 80 or 90 it is raised to between 110 to 130—with flushed face red lips warm extremities free perspiration and he will excrete large quantities of urine. He does not develop any secondary shock and usually goes on to an uneventful recovery. On the other hand a patient on whom operation is carried out without such preparation usually comes back pale with a pulse of 120 or more with cold clammy extremities and gives the surgeon 4 to 72 very anxious hours. The surgeon will then probably utilize all of these methods which should have been used before operation. It is much easier to employ methods before operation to prevent shock than to use these procedures after the operation to treat the shock often without avail.

I always perform blood transfusion when there is the slightest suggestion of an indication for it and with most gratifying results and I am not

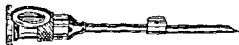


Fig. 1. C. ul. needle with obturator and perforated shield.

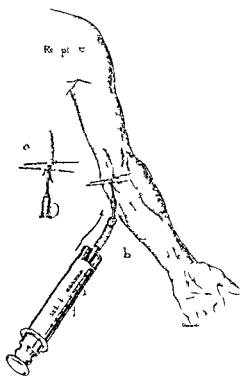


FIG. 2. Recipient's arm showing the insertion of the cannula into the superior longitudinal vein and transfusion of the cannula by a second cannula inserted through the perforated shoulder of the cannula.

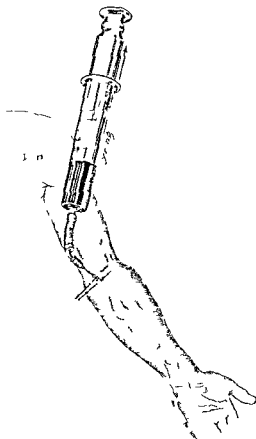


FIG. 3. Donor's arm showing curved adapter glass syringe containing blood.

overestimating its value when I state that it has lowered the mortality from 10 to 15 per cent in such major surgical procedures as complete colectomy, high gastric resection and resections of the small intestine especially in the cases of infants and children.

Blood transfusion is of special value in the various anemias in which splenectomy is indicated. Repeated weekly small transfusions in extensive carcinoma have quite a telling effect and the question of the carcinolytic action of the blood of young donors is interesting and merits investigation. Repeated small transfusions have saved many lives in the slow, mild, chronic suppurative processes that produce secondary anemias. My experience has not been very favorable however in acute infections and acute septic processes in which the patient runs a high temperature and rapid pulse and I have discontinued the use of blood transfusion in these cases believing that it has been distinctly harmful.

The statements that I have made about the use of blood transfusion in adults hold tenfold for children and infants. In hemorrhage of the new-

born especially from the gastro-intestinal tract from 50 to 75 cubic centimeters of blood given through the superior longitudinal sinus will usually stop the bleeding and convert as if by magic an apathetic, pallid, stuporous newborn babe into a normal looking child with a lusty cry within 2 minutes. A second transfusion was necessary in only a few out of a large series of these cases. In preparation for operation in congenital pyloric stenosis when the patient comes to the hospital in a stuporous or semicomatose condition with very weak and thready radial pulse I give 150 cubic centimeters of physiologic salt solution under the skin every 3 hours for 24 or 48 hours plus 1 or 2 intravenous glucose transfusions of from 50 to 75 cubic centimeters and finally 1 or 2 transfusions of 75 cubic centimeters of blood into the superior longitudinal sinus. Here within 24 or 48 hours a child which was markedly dehydrated and apparently near death is converted into a good operative risk.

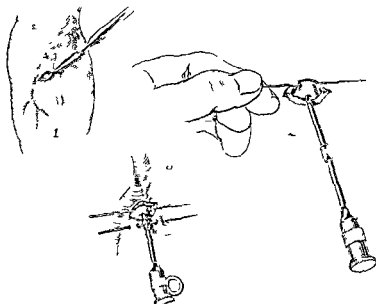


Fig 4 Method of direct syringe-cannula needle method for blood transfusion in cases of low blood pressure or poor veins

I have used blood transfusion in hemorrhages from the small intestine when a chronic anemia has existed from a small local lesion such as a bleeding Meckel's diverticulum a polyp as well as in cases of intussusception and gangrene of the small intestine when extensive bowel resections have to be performed in small children 1 or 2 years of age. The nutritional disturbances associated with diarrhea in infants and children respond remarkably sometimes to a single transfusion the child soon gaining in appetite and weight.

The effects of blood transfusion in general are improvement in blood pressure an increase of 1 000 000 to 2 000 000 red cells per cubic millimeter and an increase in the white count hemoglobin and coagulability of the blood.

It is a well known fact that blood simply exposed to the air will undergo marked chemical changes. I have observed that blood transfusion in anemias is of greater benefit and has a more lasting effect when the blood is drawn from donor to recipient with little disturbance and rather quickly so that the temperature of the blood is practically unchanged. The effects are not satisfactory when a reaction and chills occur as in the citrate method. I believe that the reactions in the citrate method are due more to these factors than to the citrate itself. By the direct syringe-cannula method I have had only about 2 per cent of re-

actions in a series of about 1 000 transfusions in 14 years. A reaction may occur if the interval in transferring the blood from the donor to the recipient is prolonged and is probably due to lowered temperature or beginning coagulation.

In order to make the use of transfusion practicable an institution should have on immediate call a dozen or more young male donors who have been grouped and who have negative Wassermann reactions within 6 weeks of the transfusion. It is necessary also to do a direct compatibility test between the serum of the recipient and the cells of the donor. The same donor should not be used twice on a patient because of the formation of iso agglutinin. A number of our recipients have changed type after several transfusions.

#### TECHNIQUE

The apparatus for the direct syringe-cannula needle method consists of three 100 cubic centimeter Luer syringe which usually hold about 150 cubic centimeters of blood a short piece of rubber tubing and two cannula needles one for the donor and one for the recipient. The cannula needle (Fig 1) contains an obturator which is beveled at the end like a spinal needle and is sharp enough to pierce the skin and the vein with ease. Midway down the cannula needle is a shoulder with a perforation of a size to admit a cambric needle.

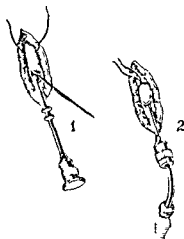


Fig 5 Method of insertion of cannula needle into the small vein of a child

The technique of inserting the cannula is as follows. A blood pressure apparatus or small rubber constrictor is set on the recipient's arm and the pressure raised up to 60 or 80 millimeters of mercury. The recipient contracts the muscles of the forearm to distend the vein. A fine cambric needle is inserted transversely to the long axis of the vein so as to transfix the skin and the upper wall of the vein (Fig 2 a and b). This holds the vein solidly against the skin and the sharp cannula needle is inserted just below the cambric needle through the skin into the vein. The cannula is set proximally in the arm of the recipient and is transfixed by a second cambric needle which passes through the skin on one side, the perforation in the shoulder of the cannula, and out through the skin on the opposite side (Fig 2 a and b). The same technique is used on the donor except that the cannula is placed distalward. A Luer syringe is washed in saline solution and rinsed in 2 per cent citrate solution, but no citrate is left in the syringe save what may adhere to the walls of the syringe. The obturator is then removed from the cannula in the donor's arm and the curved adaptor (Fig 3) with its small piece of rubber tubing and glass syringe is attached to the cannula. When the donor contracts his forearm muscles by opening and closing the hand, the blood is easily drawn up into the syringe. In fact, without any traction whatsoever, the pressure of the blood will force the plunger upward as the blood runs into the syringe. After 100 cubic centimeters or more is drawn up into the syringe, it is detached and transferred to the recipient while the assistant draws a second

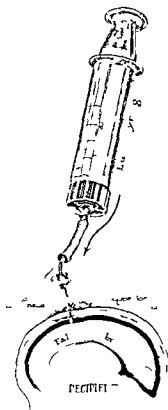


Fig 6 Method of injecting blood in an infant with open anterior fontanel. Note the metal guard on the cannula needle.

syringeful from the donor. After the syringe has been used, it is again washed in saline solution by the nurse and rinsed in citrate solution. In this way, three 100 cubic centimeter Luer syringes are kept going in rotation, and from 600 to 800 cubic centimeters of blood can easily be transfused in 10 minutes. There is, however, no necessity for haste, as the blood does not coagulate within the syringe for at least 4 or 5 minutes.

Occasionally in a patient whose blood pressure is so low that he is pulseless, or in a woman whose veins are poor, it may be impossible to enter the vein by this method. A very small incision can then be made through the skin transversely to the long axis of the vein, exposing the vein (Fig 4 1) and a cambric needle inserted through the upper wall of the vein (Fig 4 2). The cannula needle is inserted into the vein being transfixed to the skin by a second cambric needle (Fig 4 3) as in the foregoing method. If this method proves unsuccessful in the recipient on account of smallness of the vein, as in a young child, a short

longitudinal incision is made through the skin the vein is lifted and a small oblique incision made through which an ordinary cannula needle is inserted and transfixed with catgut (Fig 5 1 and 2)

In an infant with an open anterior fontanel a needle with a small metal knob is placed that the needle will just reach the superior longitudinal sinus but not go through it is used. The land mark for inserting the needle is the posterior portion of the anterior fontanel where the two parietal bones meet (Fig 6). The needle is plunged in right up to the metal guard and if the needle is in the sinus a free flow of blood results. If a free flow of blood does not result the needle should be placed to one side or other of the original puncture. One must never inject the blood unless there is a free flow of blood from this needle puncture. I have used this simple method of transfusion in infants for many years in a large series of cases without any ill results.

# CONCLUSIONS

1 The advantage of this method of blood transfusion is its absolute simplicity and the absence of any unusual devices which always produce coagulation and get out of working order.

2 The donor as well as the recipient's vein can be used repeatedly without destroying the vein.

3 The donor can be in one room and the recipient in another no proximity being necessary between donor and recipient.

4 The transfusion can be done with very little assistance. On account of its simplicity it can be carried on at the patient's bedside.

5 Blood transfusion by this direct method without citrate produces practically no reaction.

6 Blood transfusion as a prophylactic measure in patients who are questionable risks for major surgery is of inestimable value in reducing the mortality and should be used more in the future.

## RENAL ROENTGENOGRAPHY DURING OPERATION<sup>1</sup>

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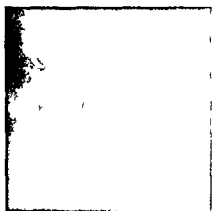
THE surgeon's dilemma at the conclusion of an operation for renal stone is obvious.

Has he removed all of the particles and fragments or has he left some to act as nuclei in the formation of more stones? Has he damaged the kidney unduly in his effort to free it entirely from calculi? Would it not have been better to have sacrificed the kidney instead of making exploratory transcotical incisions to reach the tips of the calyces? His position is much worse however when he fails to find a stone previously shown by the X-rays and localized as accurately as possible as being in the renal pelvis. Further more cases of recurrent stones are reported when there is no positive evidence that they are not relicts. One surgeon, Dr. J. D. Barney, has checked up his work by postoperative X-ray examination and finds recognizable particles or fragments remaining in 45 per cent of his cases (1). His article gives an excellent resume of the difficulties to be met and overcome which will not be repeated here.

Braasch and Carman were the first to suggest a procedure to meet this dilemma (2, 3), a procedure which has certain objectionable features as applied in various hospitals and clinics through-

out the country. They advocated fluoroscopy at the operating table using a portable machine and an ordinary fluoroscopic screen (provided the operating room could be darkened). The kidney was mobilized and lifted above the horizon of the body by gauze strips, all sponges, clips, pad and instruments were removed, the wound was draped with a sterile sheet or towel and the fluoroscopic table equipped with a sterile metal pointer was then called upon to locate the stone.

We have attempted this procedure using a head fluoroscope (as the operating room could not be darkened) and found it quite unsatisfactory for reasons which will be explained. The method was therefore modified to permit the use of a film small enough to be shipped into the operative wound behind and below the exposed kidney and a radiogram of the kidney was then made, a small portable or bedside machine being used. The film is enclosed in a small rubber bag which has previously been sterilized and dried to prevent soiling of the operative field. Such a film can be developed, fixed and returned to the operating room in a few minutes and the surgeon can see for himself the exact location



Fig

Case	Pre-operative	film	how	gl	rg	al
cul blocking the	et ropel	j nct	d t	m	ller	
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Fig. 1

Fig. C e 2. Films to operate in A sh w s two large fragments B sh w after their removal a small collection of sand. Note the air in the dilated calyces.



Fig. 2 B

ize number and character of the shadows. This is the first and one of the most important advantages of this method as compared with that of Braesch and Carman. Instead of relying upon verbal descriptions or directions the surgeon can see at a glance what the condition is and what must be done. It is almost a platitude to state that direct observation by the operator is decidedly more reliable than an indirect and second hand verbal impression in such a case but it is obviously true.

The time element is essential in two ways. While very little time is consumed in taking a single peep at the kidney with the fluoroscopic screen a number of such examinations repeated at intervals are required and therefore the total time consumed is more than that required for the taking of a film. Furthermore fluoroscopy demands a trained roentgenologist and consumes his time both in sensitizing his eyes and waiting for the surgeon to mobilize the kidney. With the film technique an assistant technician or nurse can do the work at any moment needed and the films can be repeated as frequently as is necessary. As regards total time consumed it was demonstrated at a meeting of the Clinical Congress of Surgeons in October 1923 at our hospital that 10 minutes was the maximum time necessary to wheel up the machine, take the film, develop it and return it to the operating room. Less time in fact than the roentgenologist would use in preparing his retinae for fluoro copy.

In fluoroscopic the kidney there is no protection against the rays except that of the fluoroscopic screen. The surgeon and his assistants are also exposed at times for several minutes.

(at interval of course) while with films only 2 second exposure is necessary and consequently there is very little danger of an X ray dermatitis. If the operating room is one that cannot be readily darkened a head fluoroscope must be used which is even more unsatisfactory and offers practically no protection.

Fluoroscopy is quite unsatisfactory if the kidney cannot be lifted out of the operative wound but this fact does not in the least interfere with satisfactory films.

As is evident in other branches of our work there is no comparison between a fluoroscopic impression and a clean cut film for detail and accuracy and it would be quite possible to miss small particles of sand or large fragments of soft stones (e.g. the unc acid or negative calculi) on the screen which would be well shown on the film.

Finally, the value of a permanent record is evident. It is a question of fact versus opinion and needs no discussion.

## PROCEDURE

The portable X-ray machine is placed in the operating room and tested before the operation begins. A small rubber bag is sterilized and placed on the instrument table. Films 4 by 5 inches in size are kept on hand and when the occasion arises one of these is dropped into the bag the

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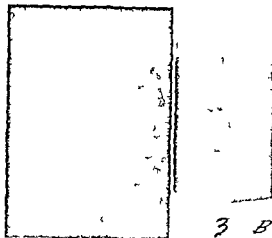


Fig 3 Case 4 Pre-operative film A and operative film B



Fig 4 Pre-operative film A (left) and operative film B (right) showing a large calculus in the middle calyx. A shows it to be in the middle calyx.

open end of which is folded over. This film is then placed under the kidney, the latter being lifted or held by gauze strips or tapes. The machine is wheeled into place and an exposure of 2 to 5 seconds is made depending on whether the kidney is free or buried. (It is well to overexpose the film so that it will develop quicker.) The film is then developed, fixed, and returned to the operating room or a report may be sent if the kidney is entirely free from stones. As noted above, the whole procedure requires but 10 minutes.

#### RESULTS

So far 5 cases have been examined. In 3 cases exposures were made to locate shadows thought to be calculi on the pre-operative films and not found at operation. In all 3 the calculi were shown and were then localized and removed. In the 22 remaining cases all had had stones removed and the films were made to rule out the possibility of retained fragments. Four of these showed calculi remaining which were located and removed. A technical failure may be recorded in 1 case when the surgeon accidentally turned the film so that the lead back was against the kidney. A second case was given up as the kidney could not be mobilized enough to get a film under it because of aberrant arteries. All of the renal arteries entered at the upper and lower poles so that it was impossible to do even a pyelotomy. This case could hardly be counted as a failure as the operation had to be abandoned on account of the congenital anomaly.

So far not one of these patients has returned with a recurrent stone.

The value of this procedure can best be illustrated by the following selected cases from the Urological Service of this hospital. Dr William C. Quimby has been good enough to verify them and at the same time express his appreciation of the help which this method gives him. He has informally described this procedure previously (6, 7). These cases have been encountered in the past 2 years during which time the procedure described has been practically routine in all pyelotomies and nephrotomies for calculi.

CASE 1 (33890 Fig 3) Pre-operative films showed a triangular stone with two smaller ones. A pyelogram showed the large stone blocking the ureteropelvic junction. At operation the removal of the large stone was followed by a gush of urine in which one of the smaller stones was found. The other could not be located in the gutter and thus wound in the kidney. A film made at this point showed the kidney to be entirely free of calculi thus saving the patient exploratory incision through the coat. Both calculi in the bladder were removed and the damage done to the bladder was removed.

CASE 2 (3737 Fig 4) This patient had passed crystals and small calculi in the urine for several years. Six years ago he had bilateral calculi removed and the X-ray at that time showing bilateral calculi in the bladder. He was referred to this hospital because of severe pain in the left flank. The X-ray film here showed bilateral calculi in the bladder and a shadow which appeared in the pyelogram as a gap. At operation calculi were removed from dilated lower ureters and the pelvis and the ureters and a large amount of sandy material was washed out. Three kidney films were taken, the first showing a large fragment in the second only two millimeters in diameter and the third showing a pocket in which was washed out.

It is interesting to note that these were cystine stones as were the bladder calculi and the crystals.



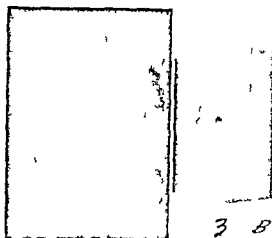


Fig. 3 Case 4 Pre-operative film. A and operative film B.



Fig. 4 Post-operative film A (left) and operative film B (right). A large calculus which was easily removed but the small stones required careful search. B shows it to be in the middle of the kidney.

open end of which is folded over. This film is then placed under the kidney, the latter being lifted or held by gauze strips or tapes. The machine is wheeled into place and an exposure of 2 to 5 seconds is made depending on whether the kidney is free or buried. (It is well to overexpose the film so that it will develop quicker.) The film is then developed, fixed, and returned to the operating room. A report may be sent if the kidney is entirely free from stones. As noted above the whole procedure requires but 10 minutes.

#### RESULTS

So far 25 cases have been examined. In 3 cases exposures were made to locate shadows thought to be calculi on the pre-operative films and not found at operation. In all 3 the calculi were shown and were then localized and removed. In the 2 remaining cases all had had stones removed and the films were made to rule out the possibility of retained fragments. Four of these showed calculi remaining which were located and removed. A technical failure may be recorded in 1 case when the surgeon accidentally turned the film so that the lead back was against the kidney. A second case was given up as the kidney could not be mobilized enough to get a film under it because of aberrant arteries. All of the renal arteries entered at the upper and lower poles so that it was impossible to do even a pyelotomy. This case could hardly be counted as a failure as the operation had to be abandoned on account of the congenital anomaly.

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**CASE 1.** (33790 Fig. 1.) Pre-operative films showed a triangular stone with two smaller ones below it. Apyrogram showed the larger stone blocking the ureteropelvic junction. At operation the removal of the large stone was followed by a guinea-fur test in which one of the smaller stones was found. The other could not be located in the guinea-fur test. In the kidney a film made at this point showed the kidney to be entirely free of calculi, thus saving the patient an exploratory incision on through the costal arch. Both calculi must have been carried out when the large stone was removed and the diminished possibility of recurrence.

**CASE 2.** (33797 Fig. 2.) This patient had passed crystals and small calculi at intervals since the age of 15 years ago. He had a bilateral calculus removed the previous year showing bilateral renal calculi but further operation was refused. He finally came to this hospital because of severe pain in the left flank. The X-ray film showed bilateral calculi in which less than normal shadow appeared in the pyelogram as negative shadows.

At operation a calculus was removed from dilated lower calyx of the pelvis and the ureter and a large amount of sandy material was washed out. Three kidney films were taken the first showing several fragments the second showing a small stone and the third only a pocket of sand which was washed out.

It is interesting to note that these were cystine stones as were the bladder calculi and the crystals

# A BODY REST FOR MAINTAINING PATIENTS IN PRONE POSITION FOLLOWING INTRACRANIAL OPERATIONS

BY L. K. FERGUSON, A.B., M.D., PHILADELPHIA

F. M. H. D. P. M. E. T. I. N. G. E. R. Y. H. O. S. P. I. T. A. L. U. N. I. V. E. R. S. I. T. Y. (P. A.)

IN the practice of neurosurgery it has frequently been found advisable to treat patients many times semi-conscious or stuporous by placing them in the prone position (face down) and often with the feet elevated. This procedure is especially useful in the postoperative treatment of patients who have had suboccipital craniotomies, plastic operations for posterior meningocele, and in high cervical laminectomies.

The prone position with feet elevated has been found most useful also in the treatment of cases of intracranial trauma and after operations on the brain when the slowing of the pulse and respiration with a rising blood pressure suggest medullary pressure. In these circumstances placing the patient face down with the foot of the bed elevated about 4 feet has been found effective in tiding the patient over until the cerebral oedema is reduced in the postoperative cases or until operative intervention can be undertaken in the cases of cranial trauma.

In order to allow for breathing space and to hold the head in a constant position we bolstered the patient with pillows under his chest and head. The disadvantages of this method were that the patient was continually sliding to one side or the

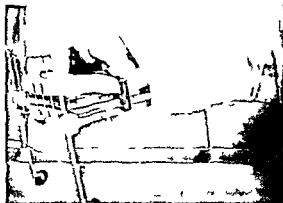


Fig. 1. Body rest use with patient in prone position.

other and when the foot of the bed was elevated he was constantly approaching and often reached the head of the bed.

We have therefore devised a triangular box well padded on the top which is slipped under the chest of the patient lifting his shoulders about 5 inches from the bed. It is made with shoulder pieces of well padded steel which fit on either side.

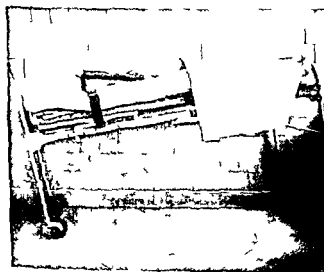


Fig. 2. Lateral view of foot of bed elevated and body rest.

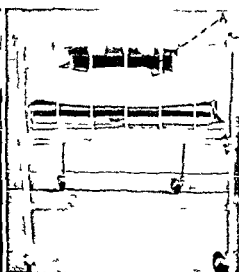


Fig. 3. Front view of body rest filled with cotton wool to support patient's head.

of the neck to support the weight of the patient when the feet are elevated. To prevent the patient from slipping downward when the foot of the bed is raised small cleats were fastened to the bottom of the box which catch beneath a steel cross piece made just wide enough to fit across a hospital bed and bent down over the sides. The cross piece may be tied or clamped to the bed frame if necessary but we have found that its rather sharp edge digging into the mattress will hold a very heavy patient in position with feet elevated

without clamps. The head is easily supported on a folded towel or sheet making plenty of room for breathing space.

The device has proved most useful in our hands and we find that the nurses are most grateful for its use because it lightens their duties considerably. The patient is easily maintained in position and he can be easily cared for when he vomits, drinks, etc. and most important the patients themselves are held for days in this position with a reasonable degree of comfort.

## CORRESPONDENCE

### BASIC PRINCIPLES AND SUPREME DIFFICULTIES IN GASTRIC SURGERY

*To the Editor*—In my article entitled "Basic Principles and Supreme Difficulties in Gastric Surgery" which appeared in the January 1925 issue of SURGERY GYNECOLOGY AND OBSTETRICS

often found associated with gastric ulcer and sub-group (a) would correspond to a diminished function of the sympathetic or an overacting vagus and to the pathology associated with duodenal ulcer.

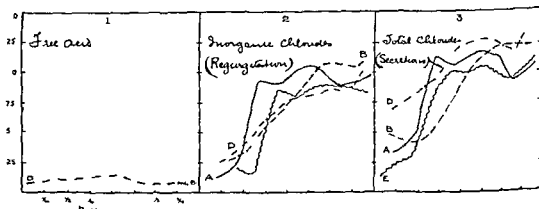


Fig. B. A series of charts illustrating the comparison of gastric and duodenal ulcer pathology. The curves represent the relationship between gastric acid secretion and duodenal ulcer pathology. The curves are labeled A, B, C, D, and E. The curves show the relationship between gastric acid secretion and duodenal ulcer pathology.

an error has been made in that subgroups (a) and (b) are interchanged. On page 2, right column, the sixth line from the bottom should read "Sub-group (b) would then correspond to an increased function of the sympathetic and to the condition

We are publishing herewith a corrected chart of Figure B which appeared on page 11 of this article.

H. B. DEWEE, M.D.

Melbourne, Australia

## EDITORIALS

### SURGERY, GYNECOLOGY AND OBSTETRICS

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NOVEMBER 1955

### SURGICAL PATHOLOGY AND THE YOUNG SURGEON

THAT an adequate knowledge of surgical pathology is absolutely essential for every well trained surgeon is beyond question but at present only a small percentage of operators meet this requirement. For us older members of the surgical profession it might be urged in extenuation that at the time of our graduation even in many of the good schools the teaching of pathology in general was somewhat inadequate. For the younger surgeon however there is no excuse whatever and it is high time that steps should be taken to rectify this defect.

It would be a great comfort to the operator to have a general pathologist on hand at all times to advise him in obscure cases but we are living in a practical world. As a matter of fact there are hardly enough professors of pathology to man the teaching schools and such being the case the pathologist has no time to stand around in the operating room hour after hour in case his advice may possibly be needed. He is too valuable a man to dissipate his energies in such a manner. On the other hand since it is absolutely essential

that a pathologist be present at every important operation it necessarily follows that this pathologist must be the surgeon himself.

The operator who has a thorough knowledge of gross surgical pathology in the majority of cases is able at a glance to diagnose the exact condition when the abdomen is opened so that he can decide intelligently whether to go ahead or to back out. In cases of obscurity a piece of the puzzling tissue is excised and a technician makes frozen sections and as a rule after a glance through the microscope the surgeon can at once reach a diagnosis. As a result he can go right ahead with his routine work without being dependent on the hour at which the pathologist can be on hand and at the same time the latter is relieved of an unnecessary and time consuming routine. Only in the very doubtful cases need he be called upon to render the final judgment.

This knowledge of surgical pathology by the surgeon then not only saves a great deal of time but also makes the practice of surgery infinitely more fascinating as the operator himself is able to get down to the rock bottom facts about his cases. In his routine work he will often encounter some rare condition a lesion which without his knowledge of pathology might mean nothing to him but which at a glance he recognizes as a rarity studies carefully and in due time adds to the literature. It is this close correlation of the clinical picture with the laboratory findings that gives the best results.

At the present day the remedy for this crying defect is in the hands of the surgical profession. In the leading clinics of the country are well manned laboratories of surgical path

ology whose doors are wide open for seekers after knowledge

There are many wide awake young internes who are anxious to become surgeons and who are applying to the various surgical clinics for assistantships in surgery. Some applicants measure up others do not. A premium should be placed on a knowledge of surgical pathology. When a suitable applicant appears he should be told that he will be accepted after he has taken at least a year in the surgical pathology of his special branch in one of the leading clinics. After the candidate has done this and has returned bringing with him a certificate from the Director of the Laboratory to the effect that he has taken the prescribed course and that he has a comprehensive knowledge of the surgical pathology of his particular branch his appointment as assistant in surgery can be duly consummated.

If this policy is adopted by all surgical clinics almost before a decade has elapsed practically all the oncoming surgeons will have a thorough knowledge of surgical pathology and once having gained this fundamental knowledge they in turn will see to it that their assistants have a similar training.

THOMAS C. CULLEN

## THE TREATMENT OF FRACTURES

THE aim of all therapy is to expedite complete recovery of function. It is attained when procedures are in harmony with the natural processes which develop powers of resistance and defense, growth and repair. Thus alone can temporary disturbances of function be restricted and the earliest restoration to normal be assured. A survey of fracture therapy from this viewpoint indicates defects and suggests remedies.

Modern practice is based upon original dogmas promulgated when physiology was mythical and the nature of repair was un-

known. Healing of broken bones we are taught requires that fragments be reapposed that the reapposition be maintained and that it be continued with immobilization until firm osseous reunion has occurred. Knowledge of the influence exerted by these procedures upon natural processes of repair is essential to progress.

Organisms, the organs and tissues forming organisms and the cells of tissues and organs require exercise and nourishment to be healthy. Atrophy follows inactivity. Atrophy is inevitable with starvation. Inactivity and hypoxemia are concomitants. Atrophic cells, tissues, organs and organisms are deficient in powers of resistance and defense of growth and repair.

Allison and Brooks (*Surg. Gynec. & Obst.* 1911 xxxiii 250; *Ann. Surg.* 1922 i 427) showed bone atrophy to occur with non-use whatever the cause of inactivation. The extent of the atrophy is commensurate with the degree and duration of inactivation. Atrophy is demonstrable radiographically and is most notable in reductions in density of the cortex and those more compact portions of the cancellated structures which together bear the normal stresses.

Atrophic bone differs from normal bone quantitatively. There is less bone within its periphery. It is more pliable or more fragile and bends or breaks when subjected to less stress. Atrophic bone unless the atrophy has progressed to osteoporosis can regain its normal structure through reactivation provided the burdens imposed are within the limits of its strength. Atrophic bone is hypoxemic. It cannot respond to irritations as effectively as normal bone and its capacity to produce callus is correspondingly restricted. Normal growth is retarded by atrophy and premature ossification of epiphyses is fostered. The therapeutic signifi-

cance of these facts is clear. Immobilization unfavorable to growth and repair is contra-indicated when avoidable. It is particularly undesirable in treating bone lesions in children. The extent of atrophy caused by immobilization can be measured nicely with radiograms. The reactivation needed to correct the atrophy is to be regulated so that intolerable burdens are not imposed. Exercise interrupted as little as possible must be moderately increased until competence is restored.

Callus is comparable to atrophic bone. Immature callus has a subnormal amount of bone within its periphery so it also bends and breaks with less stress than normal bone. Callus matures with exercise in much the same way that atrophic bone regains its natural structure. It becomes more compact and thicker along lines of stress. Other portions subjected to little or no strains undergo atrophy of non use. These changes are recognizable in radiograms. Another therapeutic aid is provided. Callus is competent to assume full physiological obligations when the increased densities along lines of stress indicate its maturity.

The formation of callus is provoked through the irritations caused by fracture. It connects and fixes fragments and replaces defects. The less the irritation and the less the displacement of fragments the less the amount of callus initially formed. The earlier callus is subjected to tolerable stresses the sooner it matures, the unexercised superfluous portions atrophy more promptly and the total production is minimized. Osseous repair *per se* is therefore favored by one constant factor activity.

Patients suffering fractures are unconcerned about the details of bone healing; they are greatly concerned about recovery of function. The functions of bone most af-

fected by fractures are its contributions to active motion. Recovery after fracture is as complete as is the restoration of active motion and health. Consequently the immobilizations imposed should not exceed the requirements surgical experience has found to hasten repair, viz. approximation of like structures with just enough fixation to eliminate excess irritation and to maintain apposition without avoidable restriction in local and general activities.

Nature and clinical experience (Ann Surg 1925 October p 617) prove the value of reducing immobilization to the lowest requirements for safety. They have demonstrated that reappositions of fragments need not always be exact to permit of healing with complete functional recovery and that aids to maintain reappositions can be superfluous even in fractures of long bones. Nature and experience have proved that active motion is a constant factor in recoveries from all fractures. Active motion can lead to more accurate reappositions of fragments after some fractures of bones in hands, feet and pelvis, for example, than can be obtained by manipulation.

The conditions determined by man (reapposition, fixation and immobilization) to be fulfilled in treating fractures can all be ignored at times and yet functional recoveries may be perfect. The condition found by Nature (active motion) to propitiate bone healing can never be neglected and functional recovery be attained. Reapposition, fixation and immobilization are needed in treating some fractures. The need has been overestimated. Active motion is needed in treating all fractures. The need has been underestimated. Progress will be made as rapidly as experience determines how little assistance Nature must have to effect satisfactory repair of each fracture.



The immediate and remote disability due to fractures is greater than the nature of the lesions warrants. Reductions in fracture disabilities have not equaled the reduction in disabilities from other injuries treated surgically. Appreciation of the economic losses to individuals and to industry resulting from fractures is the cause of growing dissatisfaction with modern fracture therapy. An analysis of reason for present conditions is illuminating.

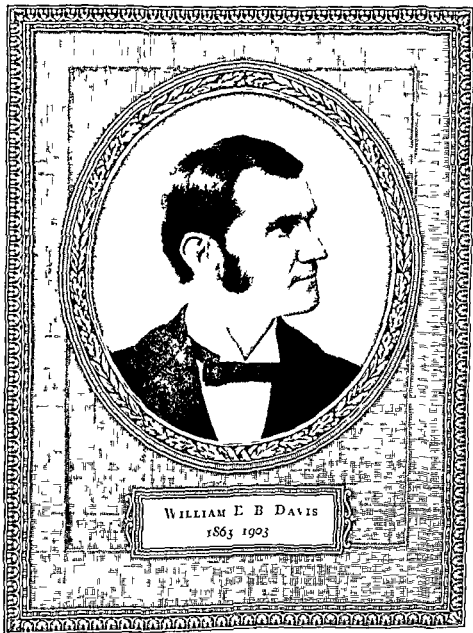
Fractures are just as important today as when they constituted the major portion of surgical practice. General surgeons have become more interested in other fields. Treatment of fracture has been delegated to orthopedists, particularly in the larger and more authoritative institutions. The majority of clinicians have not appreciated the superiority of biology to precedent as a basis for therapy. Method and result have been overemphasized. Rationale has been neglected. Attention has been focused upon technique particularly by specialists. The procedure devised by orthopedists for use in the treatment of fractures have been many and valuable. They deserve little criticism and much credit.

The criticism if any may be made is of medical education. The old complaint that the basic sciences are not taught so as to establish their practical aspects still exists. The real reason is that those engaged in clinical teaching are neither prepared nor compelled to develop and to utilize biological sciences in preaching and practice. It is somewhat humorous to realize that the gap between the scientific and clinical departments which so many philosophers have attempted to bridge will be closed by economic pressure for more effective therapy.

An immediate remedy suggests itself. Surgical divisions in medical school are composed of independent departments under various peculiarities. Their efforts want coordination. Teaching lacks harmony. Students are bewildered by contradictory statements. Basic principles are not established and emphasized so that their constant applicability is recognized. Teaching and practice would benefit if the professors of general surgery were more actively interested in surgical specialties and if surgical specialists were in closer affiliation with general surgery.

J. L. LARSEN





# MASTER SURGEONS OF AMERICA

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## WILLIAM ELIAS BROWNLEE DAVIS

**W**ILLIAM ELIAS BROWNLEE DAVIS great original investigator teacher organizer leader and surgeon was one of the South's greatest contributions to the advancement of medicine and surgery. He was a man of rare charm culture and skill. On any occasion he would instinctively attract attention as a man of pleasing and commanding appearance and as one whose knowledge entitled him to recognition and leadership. His ancestors were for several generations physicians. His grandfather Daniel Davis was one of the early settlers of Alabama. His father Elias Davis a distinguished officer of the Army of the Confederacy was killed while commanding sharpshooters at Petersburg Virginia leaving a young widow and two sons, J. D. S. Davis age five and William Elias B. Davis age one. The death of the father and the devastation of the war left the heroic mother in most adverse circumstances. Land she had but no means to cultivate it. The whole space allotted to this sketch could justly and profitably be given to relating the early struggles of these two brothers and their mother which enabled the sons to become pioneers and leaders in surgery.

Elias Davis recognized no bounds in his search for knowledge. This was his life work to secure knowledge and truth and to develop himself into the most useful generous and serviceable human being that it was possible for an aspiring mind to become. His early education was secured in the community school at Trussville Alabama and later at the University of Alabama. He studied medicine at Vanderbilt University the University of Louisville and Bellevue Medical College New York graduating in 1884. He immediately associated himself with his brother Dr. J. D. S. Davis in Birmingham Alabama.

In 1887 Dr. Davis visited foreign clinics and did special work in England and Germany. He spent quite a time with Sir Lawson Tate in Birmingham England after which he returned to his duties and association with his brother in Birmingham Alabama. Thus was initiated a career marvelous in its brilliancy glorious in its achievements and utterly sad in its sudden ending by a railroad crossing accident in which Dr. Davis was killed February 24 1903.

Dr. Davis needed not the eloquence of an Osler to teach him the master word in surgery work he had always done work of a masterful kind he was destined

to do. On returning to his practice he improved every available moment. By close observation, experimentation and diligent research—amid inconceivable difficulties—he pursued his own original investigations. He perfected his operative technique by work on cadavers and proved his technique by operations on dogs. This he did throughout his professional career. An operation that he conceived as being possible and serviceable to the human being was established as being such by an original operation on dogs before he adopted it as a safe procedure in his surgical work. Dr. Davis never grew weary in his study, investigation and discussion of operative technique. He was often dramatic in emphasizing the absolute essentials in successful operative work. Among these were asepsis and antisepsis, the proper incision, use of retractors, abdominal packs, least trauma to tissue and viscera, identifying structures—the normal and the abnormal, the safest operative procedure, the intestinal anastomosis that was aseptic if possible, did not leak, with good blood supply and a large or adequate lumen, drainage or not, and if drainage, the proper method and material to be used, the doing of that which should be done, and the removal of that which should be removed, and nothing more, leaving no necrotic tissue and no normal tissue with the blood supply destroyed. He regarded the pre-operative preparation of the patient, the operation, and the postoperative treatment with a suitable period of convalescence as being a part of the operation. He considered that possibly the greatest lessons were learned in the autopsy room. It was there that the hopeless effort or possibly an error in diagnosis or defective technique would be indelibly impressed on the mind. He was not satisfied in case of a surgical mortality unless he could know by an autopsy that he had done everything possible to prevent it. If his diagnosis was wrong or his technique at fault, he considered it of the greatest importance to his surgical progress that he know the real truth as revealed by the autopsy.

In 1892 he experimented upon 200 dogs for the purpose of determining the safest treatment of common duct obstruction. The principles established by his conclusions are that sterile bile is inoffensive to the peritoneum, that after removal of calculi from the common duct, suture of the duct is unnecessary and indeed harmful. The observations of Dr. Davis have lessened the dangers and simplified the technique of choledochotomy. It is gratifying to note that all surgeons in this country accord to Dr. Davis full credit for this distinct advance in this field of surgery.

Dr. William J. Mayo says: Dr. Davis' original experimental and clinical work on the infection of the common duct, one of his many notable contributions to surgical literature, gave him an international reputation.

Recognizing the educational value of medical associations, he allied himself at the beginning of his career with the principal general and special medical and surgical societies of this country. He and his brother recognized the need of a

special surgical and gynecic society and organized the Alabama Surgical and Gynecological Society. At this time he conceived the possibility of an organization of wider scope. To the accomplishment of this purpose he bent all of the energies of his enthusiastic nature and as the result the Southern Surgical and Gynecological Association now the Southern Surgical Association was organized in 1888. Dr W. E. B. Davis was elected secretary and active executive officer. His conception of the usefulness and possibilities of such a society was grand in its comprehensiveness. By personal appeals by tireless correspondence and by frequent public addresses he elicited the co operation of surgeons of the entire country.

Dr L. G. Woodson in the welcome address to the Southern Surgical and Gynecological Association when the statute of Dr Davis was unveiled said

This magnificent association is a greater and more lasting monument to the memory of William Elias Brownlee Davis than the statue of bronze which you will tomorrow unveil. The old aphorism "A man is not without honor save in his own country" does not apply to our distinguished dead. He did not have to seek fame and fortune in a foreign land but in this city within a stone's throw of the place of his birth we find him stepping almost without an interval from comparative obscurity to the most honored and exalted positions which the greatest and most scientific of all professions could bestow.

Success attended every undertaking of Dr Davis. He had been active in the medical council of his state and the nation for more than fifteen years. In 1887 at the age of 24 he was president of the Tri State Medical Association of Alabama, Georgia and Tennessee (now Southern Medical Association). In 1893 age 30 he was chairman of the surgical section on abdominal surgery and gynecology in the first Pan American Medical Congress, vice president of the second Congress and vice president of the American Medical Association and chairman of the section of obstetrics and gynecology in 1900, president of the American Association of Obstetricians and Gynecologists and in 1901 president of the Southern Surgical and Gynecological Association. He was honorary fellow of the state societies of New York, Louisiana and of the British Gynecological Society. A man so conspicuously and constantly in the foreground of his profession must possess unusual traits of character and transcendent elements of success.

The intense interest of Dr Davis in medicine and surgery, his great interest in young men and his indomitable spirit as a teacher caused him and his brother and a group of learned and distinguished members of the medical profession to organize in the City of Birmingham a medical college in 1894 now a part of the University of Alabama. The reputation of Dr Davis as a great surgeon of national and international reputation and the reputation of the able and distinguished men who were associated with him caused young men to come to the institution in which he taught abdominal surgery and gynecology. These young

men imbibed the spirit of the great teacher and many of them are today distinguished surgeons throughout the South and other sections of the country. It is not too much to say that the influence of Elias Davis on the lives of these young men caused them to grasp a vision—the possibilities of the highest attainments and the greatest service in the cause of humanity. These men today sing the praise of their ideal man and surgeon Elias Davis and of his lasting influence on their lives.

Under the guidance of his mother, Dr. Davis had been trained and brought up in the Baptist church. No man was more devout in his worship and sincere in his belief in the Almighty as the source of all life, all blessings and true happiness. Surely this is a wholesome lesson in this day of argument as to how man came into existence and his destiny. In the state and county medical societies and his public addresses he never failed to emphasize the importance of the prevention of disease. *He gave individual communion cups to his own church years before his untimely death.* In this way he taught a lesson and set the example for all Baptist churches. This is but an example of his interest in the public health and his method of accomplishing what he knew to be right and proper. While he stood fearlessly for what he knew was right in the presence of opposition he acted with such consideration for others as to command their respect and esteem.

*While Dr. Davis was unsurpassed as a southern gentleman of rare attainments and greatly beloved and highly honored by the profession and the people of the South and while he never lost an opportunity to praise the southern people and to point out the shining lights among her great men in the various professions and vocations whose names and achievements he revered and honored and while he was devoted to every sentiment and principle which were held dear to the people of the South his great mind was national and international. For him our profession knew no sectional limitations or national boundaries. His mind was so brilliant and his purposes so lofty and pursued with an enthusiasm and energy so untiring as to attract the humble and the great to him. These friends respected, admired and loved him for his attainments, his nobility of character and his great unselfish services in the interest of humanity and the advancement of science and surgery. The prevention of disease, the cure of disease, the amelioration of suffering and the application of scientific facts in surgical procedure were to him the very essence of joy and happiness. Life to him was synonymous with service and achievement. He was happy in the thought that through his efforts some one might be made stronger and better and that life itself might be saved and prolonged. He was one of God's noble men whose presence inspired confidence and trust. The fragrance and influence of his life now live in his native community, city, state and indeed throughout the Southland. His achievements and teachings in surgery are recognized by the greatest surgeons.*

Dr Davis married Miss Gertrude Mustin in 1898 Mrs Davis still lives in Birmingham Two lovely daughters blessed this union They are Mrs Edward Day Harris of Birmingham and Mrs David Batchelder who resides in Chicago

William Elias Brownlee Davis the master surgeon was a great exemplar of truth righteousness and service He lives in the lives of thousands who knew him and loved him and through them his life principles will be perpetuated throughout eternity What he wrought cannot be destroyed by time Truly to have lived such a life and to have wrought as he did though the span of his years was less than forty should be sufficient and equal to all requirements of God and man and should satisfy the aspirations of the noblest soul

E P HOGAN



# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

BY ALFRED J. BROWN, M.D., F.A.C.S., OMAHA

### THE SURGERY OF JEAN TAGAULT

IT is natural and to be expected at the inception of a science and scientific teaching in which category surgery during the sixteenth century might properly be classified that the practitioners and students of that science would fall into two classes. The first those in actual practice the field workers so to speak who would act as the pioneers of new thought and method and do much toward furthering the budding art of surgery. To this class belonged such men as Laré Tagliacocca and Clowes—men for the most part of a lesser education than others but intensely interested in the practical side of their work. The second group consisted of men who were well educated and who were interested more in fostering and teaching surgery than in its actual practice. To them naturally the works of the older authors appealed and one of their aims was to place this work in an assimilable form for their students who were of the educated class. These men had little use for men of the clinical and practical type most of whom had sprung from the rank and file of the lower classes and were essentially not educated men. Consequently their works were written in Latin rather than in the vernacular. This to them appeared to be a method of keeping surgery on a high plane. These two classes of surgeons both considered themselves true scientists and rightly so but were constantly endeavoring each to belittle the other. Consequently this period shows a sort of three fold enmity for the practical class was constantly endeavoring by word and deed to get after the itinerant surgeon who was in the majority of cases an out and out quack while he himself was under fire from the savants. So he who was really doing the greatest work for his science found himself as it were between the upper and the nether millstones.

Jean Tagault (Joannes Tagaultius Ambianus Viniensis) belonged to the class of the savants and highly educated men. Born in Vimeu in Picardy he studied in Paris and in 1523 or '24 was awarded the degree of Doctor Regent by the Paris Faculty. After some time spent in the study of surgery he became dean of the faculty and served in that capacity from 1534-37. He died in 1545. As would be expected from his training there is little new in his work as far as advance in practical surgery is concerned. He did however adapt what was good in the works of the

ancient and medieval surgeons and classify it in a clear and concise manner for the use of those students who understood Latin. He had a great admiration for Guy de Chauliac and his surgery served as the basis for Tagault's work though many other authors are mentioned. Tagault freely admits this in his preface to the reader in which he states that as Guy de Chauliac borrowed from Hippocrates and Galen's he borrows from Guy and his endeavor is to clear up the obscure points in Guy's work as it was Guy's to elucidate that of his predecessors.

The work was published in 1543 in Paris by Christian Wechel a book seller and consists of the Five Books of the Institutions of Surgery by Jean Tagault to which is added a sixth book containing the Materials of Surgery written by Jacob Hollerius a physician of Paris. There is the usual dedicatory epistle which in this case is written to King Francis I and this is followed by a Compendium of Surgery which takes up the objects and aims of surgery in the form of short paragraphs some of which are arranged in question and answer form. This occupies twelve pages. The student who read this would have sufficient knowledge of what he was to study to go on to the main work or the five books of surgery. These follow the general divisions of the surgeries of the ancients and are entitled: Book one tumors contrary to nature includes the various inflammatory swellings as well as true tumors and also treats of hernia in which classification varicocele is placed. Book two takes up wounds and their treatment. Book three treats of ulcers and their cure. Book four the reduction and cure of fractures. Book five the recognition and replacement of dislocations. The sixth book by Hollerius takes up the various medicaments used in surgery.

Save for three views of the human skeleton the work is without illustrations and one naturally experiences a feeling of pity for the student who had to assimilate the greatly condensed technical detail served up to him without the aid of visual impression. The work represents a distinct advance as a textbook and served in this capacity for many years. Ancient terms are clearly explained and synonyms are always carefully correlated so the student could recognize the terms in all languages. Later authors constantly refer to Tagault and his dicta as authoritative and this work lifted him to the pinnacle of his success. One is amazed at the amount of research that must have been done to produce the work.

## REVIEWS OF NEW BOOKS IN SURGERY

CERTAIN sections of Carson's *Modern Operative Surgery*<sup>1</sup> seem to us particularly well written and worthy of special mention. Platt's monograph on operations on nerves, Choyce's chapter on operations on the tongue, Handley's discussion of the operative treatment of malignant disease and breast operations, and Walton's chapter on operations on the thyroid are a few of many sections that appeal to the reader as particularly well studied and helpful. Carson's chapters on gastric surgery and excision of the rectum are splendidly illustrated and written with especial attention to technical details. Turner's discussion of operations on the liver and bile passages is an admirable and comprehensive presentation of the surgical treatment of diseases of the bile tract.

Included in the second volume are sections on the surgery of the ear, the eye, the nose and pharynx, the larynx and trachea, on gynecological operations and five chapters by Thompson, Walker and Everidge on genito urinary surgery. The inclusion of these special subjects helps to give a comprehensive and well rounded view of the field of operative surgery.

A few critical suggestions may be worth recording. In the extensive section devoted to gastrointestinal surgery no mention is made of duodenal ulcer and its treatment except in connection with acute perforation of peptic ulcers. In the discussion on obstruction of the small intestine the statement is made that enterostomy which may be called the last resource in small intestine obstruction nearly always ends disastrously. This does not seem in accord with many recorded experiences in which a two stage operation, i.e. a preliminary enterostomy and secondary operation later, proved the successful solution of a difficult problem. The advisability of primary closure of the abdomen after cholecystectomy is not considered. Purpura hemorrhagica is omitted as an indication for splenectomy. With reference to the operative removal of pituitary tumors the statement is made that the operation is associated with such a risk to life and is followed by such doubtful benefit that it is questionable whether any radical operation is justifiable. In the section on the treatment of trigeminal neuralgia considerable space is given to a discussion of alcohol injections, division of the second and third divisions of the nerve with occlusion of their foramina and removal of the gasserian ganglion, and but two paragraphs to division of the sensory root, a method which has come to be recognized as the one satisfactory form of surgical treatment.

The last four points emphasize what seems to us a real omission—the small number of references to the literature of recent years. One feels that in pre-

senting a new work on surgical treatment the authors should give particular consideration to the advances that have been made in surgical fields since other and similar works have appeared. Of some forty references in the section on gastric surgery for example, we noted only two to articles that appeared after 1922. On page 570 the statement is made that the latest results of resection of the stomach from a large clinic are contained in an article by C. H. Mayo published in August 1919.

S. L. KOCH

The excellently prepared compendium on surgical technique by Irintz<sup>2</sup> is bound in loose leaf form with the expectation of adding sections as advisable. Up to the present time the subjects covered are general operative technique, operations on the intestines, stomach, gall bladder and bile ducts, operations for inguinal and femoral hernia, operations on the kidney and ureter, the breast, the thyroid gland and the blood vessels.

The articles are short, concise but cover the essential points of technique. They are beautifully illustrated and the drawings were made by W. C. Shepard.

IN this mechanical age when the cystoscope, the microscope, the sphygmomanometer, the fluoroscope and innumerable other instruments are being relied upon more and more in establishing a diagnosis, *Diagnostik mit freiem Auge*<sup>3</sup> compels especial interest. To be able to make a diagnosis by means of the unaided eye would seem impossible to most of us except in a limited number of cases such as some conditions of the skin and possibly bowlegs. We are ever in the habit of bemoaning the lost art of careful observation but it does not occur to us to try to resurrect that art. Weiss has attempted to do this. And in the attempt Weiss has found that careful inspection of the patient will in a large number of cases reveal more than our most elaborate of laboratory instruments. In a very detailed manner the author describes his method of ectoscopy (careful scrutinizing observation as differing from endoscopy which is applied to the inside of the body with the use of instruments or from other methods such as percussion, X-ray examination, etc.) especially in reference to intrathoracic conditions. The results of his studies are extremely interesting and the scope surprisingly wide.

The chief merit of the book, outside of the use the method may be put to in a certain limited number of cases, lies in the fact that the author emphasizes the importance of careful observation.

RALPH BOERNE BETTMAN

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M. OF RATIVE SUR. Ed. ed b. H. W. Cars. P. R. C. S.  
(Ea.) Vol. 1. ed. N. Y. York. With n. Wood & C. mpa. y. 9. 5

IN the booklet on the surgical treatment of pulmonary tuberculosis Gravesen<sup>1</sup> discusses the indications, methods and results of the surgical treatment of tuberculosis of the lungs as used at the Vejlebjerg Sanatorium, Denmark.

For many years Gravesen has been the medical director of this sanatorium. Like his predecessor Christian Saugman and like several other European authorities on tuberculosis Gravesen is not only a clinician but a roentgenologist and surgeon as well. Thus in this book we have a résumé of the work done in a large sanatorium over a long period of years written by a man whose experience is not along one single line of treatment or one method of examination but by an author who is equally skilled in diagnosis whether medical or roentgenological and in treatment whether medical or surgical.

The book describes briefly, concisely and very clearly the various surgical procedures in the treatment of phthisis. The indications and contra-indications, the steps in technique and the prognosis are discussed. The text is well illustrated by diagrams, drawings, photographs and numerous reproductions of X-ray plates.

To the reviewer it seems that the indications for the operations discussed are very sound; that the procedures advocated are very sane.

The book covers the subject of the surgical treatment of pulmonary tuberculosis very thoroughly and concisely and will prove of great value to any physician treating phthisic patients or to any surgeon operating for the relief of tuberculosis of the lungs.

RALPH BOERNE BETTMAN

TWO volumes of the new series of the *Précis de Technique opératoire* on minor and emergency surgery and surgery of the urinary system and male genital system have been received. As in the past these two volumes excellently fulfill their intended mission. In short and concise form the technique of the various operations as practiced by the authors is described. In the volume on urgent surgery the chief indications are mentioned in all other volumes only the operative technique is discussed. The series is published for students and for general practitioners whose wide sphere of activity requires a short treatment of a subject.

The reviewer has been extremely interested in reading these two little books not only because of the many excellent technical procedures found but especially because much of the French surgical thought and attitude is reflected from their pages.

RALPH BOERNE BETTMAN

ORIGINAL TEXT BY J. GRAVENSEN, M.D., Vejlebjerg Sanatorium, Denmark. Translated by J. G. WOOD, M.D., New York. Published by William Wood & Company, New York.

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# SURGERY, GYNECOLOGY AND OBSTETRICS

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## INAUGURAL ADDRESS WITH REMARKS ON ENDO-ANEURISMORAPHY<sup>1</sup>

BY RUDOLPH MATAS M.D. F.A.C.S. NEW ORLEANS, LOUISIANA

**D**URING the first 7 years of the existence of the American College of Surgeons it was my good fortune to have been associated with its directorate as one of its vice presidents. Thanks to the robust health of our presidents and to the smooth running of the administrative machinery my duties were largely if not entirely nominal but they gave me an opportunity to acquaint myself with the magnitude of the enterprise in which the College had embarked and the complexity of the problems that it had to solve. It also gave me an opportunity to admire the knowledge and skill of the captains who guided its destinies.

And now that through your grace I am here I realize more than ever that what little I may have done to live up to the ideals of the organization and to serve its interests may be said with a whole hearted devotion to its purpose has been crowned with a reward out of all proportion to any personal merit that I may possess or that may be attributed to me. I therefore interpret your action as a gracious compliment to the surgeons and surgical institutions of the South to which I belong who form so large a part of the constituency of the College and whose loyalty, unflinching support and championship of the principles of this College since its foundation you deemed worthy of recognition.

If I am right in this interpretation I feel doubly honored as there is nothing I hold

dearer nor distinction that I prize more highly than to be honorably identified with the people, the profession and the institutions of that section of our Southern country which gave me birth and with which I am inseparably united by ties of affection and devotion that are as precious and enduring as life itself.

A thought that is well calculated to moderate any sense of exaltation that might spring from the new dignity which you have conferred upon me is that of the obligations that attach to it. Not the least of these is to maintain the high standard set by my illustrious predecessors in office. When I think of the great leaders who have adorned the presidential chair during the thirteen youthful but momentous years that this College has been in existence when I recall the names of John M. T. Finney, George W. Crile, William J. Mayo, George E. Armstrong, John B. Deaver, Harvey Cushing, the late Albert J. Ober and Charles H. Mayo when I think of these I see before me a group of stalwart giants towering above the multitude whose surpassing vision I would envy were it not for the comfort that I find in the fabled legend of the dwarf and the giants told by our ancient Master Guy de Chauliac to encourage his ambitious students. The dwarf eager to see but denied by his stature was rewarded by a splendid view of treasures of marvelous wealth by climbing and standing on the shoulders of giants. Likewise by standing on the

Read before the Clinical Congress of the American College of Surgeons, New Orleans, Louisiana, October 3, 1925. Accepted for publication October 10, 1925.

shoulders of my predecessors what a privilege this is that I should be vouchsafed the opportunity of gazing upon the inspiring and magnificent panorama offered by the ever expanding conquests of American surgery.

As I survey this brilliant assembly of the most representative surgeons in America gathered before me and read the past the present and the future in the earnest faces of the men and women who represent the diverse generation of productive workers in our special domain—including those who have accomplished the now accomplishing and those who are still to accomplish the great deeds that are to exalt and perpetuate our traditions—I feel more than ever thankful for the privilege of viewing so glorious a prospect from this commanding height.

But while I have reason to approach my duties with some doubt and trepidation I am confronted and reassured by the fact that I am here solely to execute your good will to carry out your mandates and to strive for the attainment of the high purposes and ideals which each and every one of you my dear Fellows has pledged himself to hold to defend and to enforce if need be. With your support and under the direction of the splendid men whom you have chosen for your directorate the Board of Regents and aided by the generalship and vision of that watchful and tireless guardian of the machinery of our organization our Director General he who is counsel as originator and founder of the College always commands our confidence and highest respect Dr Franklin H. Martin I have every reason to believe that at the end of my incumbency another year of progress will have been added to the unexampled and phenomenal record of achievement of this wonderful institution an institution which in its national and international breadth and scope in its origin and altruistic purpose has no parallel in the world's history an institution which we can claim without vainglory as one of the most beneficent contributions that the twentieth century has given to American surgery and through surgery to the American people—The American College of Surgeons.

And now as I see the sands in the hourglass flowing fast I am reminded that I must not

loiter since as incoming president I am expected to deliver an inaugural address.

This function as I view it offers a legitimate opportunity for indulging in the amenities and sentimentalities that spring from the emotions of an occasion of this character. In this, I fear I have already trespassed beyond my privileges. It is also customary in an inaugural address to refer to if not review the past of the organization and to forecast its future but I have been relieved in a large measure of this phase of my function by our Director General Dr Martin in an admirable report of the activities of the College embracing its history from its origin to the date of our last convocation in New York—which is so luminous an account of our purposes policies and accomplishments that it would be mere presumption to do more than refer to it as an evidence of his statesmanship perspicacity and acknowledged genius for the direction and management of public affairs.

Whatever would be left to do in the way of discussing debatable points constructive criticism and commentary or counsel for our guidance in the future was also accomplished in a masterly and scholarly fashion in his Fellowship address delivered on the same occasion by our brilliant and devoted Canadian Regent and former vice president Dr Chapman of Montreal.

In analyzing our College government he finds it not only representative and democratic but simple and effective and in this view no one who has lived under our constitution and by laws can scarcely disagree with him. Here the voters numbering nearly 7,000 active Fellows are represented by the 150 governors whom they elect for a term of three years and of whom 50 are chosen annually by the Fellows. This then is our House of Representatives. The governors in turn elect 16 Fellows who including the president the vice president the director general and the treasurer ex officio constitute the Board of Regents. They act virtually as the senate of the College. The electoral power therefore resides in the Fellows and it is the Fellows who own the College and its destinies lie in their hands. In this way the College is as far removed from class domination as it is pos-

sible for our constitution and by laws to make it Furthermore ours is a democracy which is not disturbed by the clashing of party lines It is held together by a unity of purpose which allows of no division In this your president is again fortunate Viewed in the light of established precedent and the immense significance that is attached to an inaugural address when the orator is the spokesman of a political party dominant in the affairs of government an inaugural address is one to whose message the modern world harkens with ears bent to the ground or rather in a more modern way to the phone to the radio or reads the news with eyes fixed on the glaring bulletin in the street with anxious expectancy In party politics an inaugural address is the voice that confirms the pledges and policies of the platform of the new administration How happy is your president that he has no party policies to announce no party interests to promote or protect no pledges to redeem no anticipated favors to bestow No nothing but to stand firmly on a platform built upon a solid rock and immutable as the ages therefrom to proclaim his allegiance and fealty to the will of his constituents they who have all and singly pledged themselves to support maintain and defend a constitution which is based upon the principles of right conduct in the exercise of their professional mission principles which are to remain inviolate and imperishable as long as the heart of humanity is true to itself

#### ENDOANEURISMORAPHY<sup>1</sup>

Having been relieved in this comforting way of what I interpret as the official phase of an inaugural address I will avail myself of the remaining time allowed for this function to indulge my personal inclinations in a more familiar domain Profiting by this license I will invite you to my workshop in New Orleans where you may witness the performance of an operation which I trust you will find sufficiently interesting to justify its presentation on this occasion

I will relieve you of the tedium and inconvenience of a long trip to New Orleans by transferring my surgical clinic to Philadelphia where you will see an operation for the radical cure of aneurism by the method of intrasaccular suture or endoaneurismoraphy—with which you are all no doubt familiar through the textbooks but not in the personal way that you will see it today

In selecting this motion picture as the basis of my technical address I have been prompted by several considerations not the least of which is the desire that the official duties which devolve upon me as your incoming president shall not fall too heavily upon you at the very start of your arduous labors

As a preliminary to the exhibit I must beg your indulgence for a few moments longer for an explanation of the operations that are to be projected upon the screen The picture tells the story of four patients operated upon for unusual types of ruptured post tibial and femoropopliteal aneurisms They were the first of a group of five patients operated upon last summer in my clinic at the Charity Hospital all operations involving the arteries of the lower extremity They were selected not only because they were the first available for the present purpose but because they illustrate the obliterative intrasaccular method of suture which is the simplest and most frequently applicable of the three conservative procedures which I first performed in March 1888 (37 years ago) but which I did not systematically describe until 1903 (14 years later) 23 years ago I need not detain you with a description of these three procedures since they have been so frequently described in the many articles that I have contributed to the subject and since the operation has been so often performed and made familiar by my colleagues in America and in foreign countries and not the least in frequency and success by a number of my distinguished friends and colleagues in Philadelphia

Suffice it to say that in the collected statistics which I have been able to gather from my own practice amounting to over 69 operations and those of other surgeons at home and abroad fully 80 per cent of 478 recorded op

<sup>1</sup> The word "endoaneurismoraphy" is derived from the Greek words "endo" meaning "within" and "aneurismoraphy" meaning "the process of suturing an aneurism." The word "aneurism" is derived from the Greek word "aneurisma" meaning "a swelling" or "a tumor." The word "morph" is derived from the Greek word "morphē" meaning "form" or "shape." The word "suture" is derived from the Latin word "sutura" meaning "a stitch" or "a suture." The word "endoaneurismoraphy" is a compound word meaning "the process of suturing an aneurism within the aneurismal sac." The word "endoaneurismoraphy" is a new word and has not been used before.

erations have been of the obliterative type. In 20 per cent the conditions favorable for a reparative restorative or reconstructive operation have been found and utilized for these essentially conservative procedures.

I have not included in my list of 478 cases a considerable number of operations performed by European, especially German military surgeons during the World War in which the principles of my restorative endoaneurismoraphy have been successfully applied to traumatic aneurisms but without any recognition or acknowledgment of the source from which they were derived. The results obtained by these operations continue to be even more gratifying than when I first submitted a report of the first 225 to the International Congress in London in 1913 and vary little from the report of 350 operations which I later submitted to the French Surgical Congress in 1922. The deaths that can be directly attributed to the operation (apart from the aortic) do not exceed 4.5 per cent; the gangrenes 3.5 per cent; secondary hemorrhage 1.6 per cent; and the relapses in less than 1 per cent. These operations include all the surgical arteries of the extremities from the iliacs to the foot, from the subclavian to the hand. I treat the aneurisms of the neck, subclavian and innominate tracts primarily by the simple occlusion of these great vessels with pliable aluminum bands or tape ligatures applied as closely to the cardiac pole of the aneurism as is possible. The results obtained by this method—which will be made the subject of a separate publication—have been so satisfactory and curative that with the sole exception of the arteriovenous aneurisms of these vessels I have not had to resort to more radical procedures.

The obliterative operation which consists essentially in a direct incision into the sac without dissecting it from its surrounding, the evacuation of its contents and suture of every visible orifice within the sac that might bleed followed by the obliteration of the sac cavity by infolding or plicating its wall or filling it by inverting and approximating its muscular walls is by far the most conservative, simplest and safest of the radical operations for the cure of aneurisms of the extrem-

ities. Since I have learned with increasing experience how to determine the efficiency or inefficiency of the collaterals by the four tests that I have found most practical and dependable, namely (1) the hyperemia reaction or modified Moszkowicz color test (2) the preliminary occlusion of the main artery close to the proximal pole of the sac, with pliable and removable bands (3) oscillometric manometry to determine the peripheral blood pressure after the temporary occlusion of the main artery and lastly (4) the clinical evidence of a persistent circulation and nutrition of the peripheral parts in spite of the permanent absence of the peripheral pulses (the Delbet test) since I have also learned that, by systematic compression of the main artery at its entrance into the sac a deficient collateral circulation can be greatly improved in the large majority of cases with the help of other physiotherapeutic measures which tend to stimulate the capillary circulation I have found the indications for the reconstructive operation less frequent.

As it is impossible to determine before opening the sac and examining its interior whether an obliterative or restorative procedure is applicable, the surgeon should always proceed with the possibility and in fact probability in mind that an obliterative operation will become necessary. Hence the capital importance of the study of the collateral circulation in every case in which it is at all possible to observe the behavior of the distal parts upon occlusion of the main artery at the cardiac pole of the aneurism. This preliminary study of the collateral circulation is one of the most important advances in the surgical treatment of aneurism and should be regarded as an obligatory duty before any direct action upon the aneurism is undertaken.

#### CONCLUSIONS

I regard it as a fundamental principle that the surgeon should undertake all operations for aneurism with a conservative spirit. He should aim at the physiological restitution and reintegration of the aneurismal artery as his ideal. He should not exceed in his demands the local reparative resources of the tissues or of the organism.

When operating the surgeon should not obstinately insist upon re establishing the continuity of the damaged artery by juggling with complicated hazardous uncertain and adventurous methods. It is for this reason that the operation designated ideal and which consists in excising or resecting the sac and then suturing the stumps of the divided vessel by end to end arteriorrhaphy with or without the interposition of venous grafts does not figure in my statistics. This will do only for recent pulsating hamatomata. The ideal operation is that in reality which saves the patient and his limb while ridding him of his aneurism. In the presence of an aneurism developed in one of the great arteries near the heart we must reflect a long time before deciding to act. It is then that we should be *eclectic* selecting that procedure which is most clearly indicated by the condition of the patient and of the limb.

It is not because statistics seem to show that the methods of extirpation or of endoaneurismorrhaphy or others yield the greatest number the most complete and the most radical cures that we should decide to attack the central or truncular aneurisms by direct intervention on the sac. In every case the patient who is very often a syphilitic subject with other complicating cardiovascular lesions should be minutely examined so that a general inventory of his pathology and an appraisal of his defensive resources may be obtained. In the young otherwise healthy subjects suffering from purely traumatic aneurisms the operator may go very much further in the pursuit of the ideal. But in the aged and in those vitiated by diseases whose aneurisms are only a proof of their general arterial degeneration one must be practical and the theoretical technical and physiological ideal must be subordinated to the primordial consideration of the saving of life.

I reassert. The surgeon should be *eclectic* in his attitude. He should choose the simplest means by which he may suppress the disease. It is in adopting this principle that I always begin an attack on the innominate the subclavian the carotid the iliac and the ilio

femoral aneurisms by first occluding the main artery with an aluminum band or preferably in innominate and left subclavian aneurisms of the first or intrathoracic portion by tape ligation without interfering directly with the sac.

It is admittedly a serious enough matter to apply a ligature upon the innominate or a subclavian especially at the origin of these vessels but the procedure difficult as it is is far less dangerous or risky an undertaking than to attempt to obliterate or extirpate the aneurismal sac at the same sitting.

We should bear in mind that in probably 80 to 85 per cent of these cases the simple occlusion of the main artery is sufficient to obtain a cure of the aneurism. If a relapse follows it is then time enough to obliterate or extirpate the sac.

In the young with aneurisms of direct traumatic origin who are free from syphilis or other constitutional taint and especially in dealing with arteriovenous aneurisms I do not hesitate in a general way to attack the aneurism by a direct free incision into the sac followed by the suture of all the communicating openings within the sac. But even then I never attempt such a procedure without the most thorough control of the main or injured artery above and below the sac by preliminary provisional hæmostasis with clamps bands or temporary elastic ligatures.

Finally after security or safety it is the simplicity of any procedure which must appeal to us in deciding our choice of methods. It is by reason of its simplicity in dealing with the accessible and controllable aneurisms particularly those of the extremities that I believe that I am serving the best interests of my patients by giving them the benefit of the operation which experience has taught me is the simplest safest and surest—endoaneurismoraphy.

NOTE.—In the moving picture that followed the introduction the patients were exhibited before the operation and after their complete recovery. The details of the technique were shown as the operation progressed from the beginning to the end of the operation including the author's special protective mattress-pad dressings. The more minute details of the procedure which escaped the eye of the camera were made clear by the interposing of a number of semi-diagrammatic drawings which were continuous with the moving film.



OVARIAN GRAFTING<sup>1</sup>

By W. BLAIR BELL, B.S., M.D. (LOND.) F.A.C.S. (HON.) LIVERPOOL, ENGLAND

Professor of Obstetrics and Gynecology, The University of Liverpool; Honorary Surgeon, The Royal Infirmary and Surgeon to the Mersey Hospital, Liverpool; Honorary Secretary, Liverpool Medical Society.

THE elevation of surgery from mere tissue carpentry to the more exalted position of a highly scientific recreative art has been due to the general appreciation of the facts that every structure in the body subserves some special function and more over that although nature has endowed tissues with wonderful powers of recovery and regeneration and although she may duplicate she does not issue spare parts.

So it has come about that the scientific surgeon of today is a physiologist rather than an anatomist as obtained in the past and it has become the essential principle of modern surgery that only those structures shall be removed which are too much damaged by disease to recover or which are sources of danger or of serious disturbance to the patient. The excision of tissue therefore and with it the removal of function is now regarded as a last resort—the surgeon bends his creative powers towards the prevention of loss of function and this is especially necessary when that function is of general rather than local utility only. Ignorance as to the nature of any particular function and poor results from imperfect technique may be explanations of preference for eradicated surgery but they are not excuses.

The grafting of tissues which the operator may be compelled for one reason or another to remove from their normal position and connections is undoubtedly one of the most important advances of surgery towards the ideal I have expressed. There is indeed no branch of surgical practice that is not feeling its way in this direction following the lead given by nature in the natural history of animals and plants.

Being myself specially interested in the question of the ovarian function which I believe to be of paramount importance to the feminine female I shall illustrate the general thesis set forth by reference to the subject of ovarian grafting.

This procedure has created great interest in America where gynecological surgeons have I believe more respect for the valuable functions of the ovary than obtains in certain parts of this country where the belief is held that the ovary is an overrated organ.

As I have said I myself hold the view that the ovaries are of value to feminine women by reason of their internal secretion quite apart from the excretion of ova and I believe that nearly all failures to secure satisfactory results from ovarian grafting have been due to faulty technique and not to the fact that nature gave women ovaries only for the purpose of producing ova.

Before discussing the technique of ovarian grafting I should like if I may to repeat a statement made some years ago (2). I wish to insist that this procedure be looked upon as a measure of necessity which can never be weighed in the balance against the preservation of the natural connections of the normal ovary.

Acting on this principle I have had what may be regarded as but a limited experience with ovarian grafting—about 200 operations in 10 years. Previously to the year 1916 I had only occasionally performed this operation.

Other surgeons like Tuffier (6) have published rather larger series but with them the indications for ovarian grafting appear to have been less restricted and to have been extended to include uncomplicated cases of fibromyoma uteri and other conditions, in the treatment of which this procedure is rarely necessary unless they are associated with tubal infection.

## INDICATIONS FOR OVARIAN GRAFTING

In view of what I have just said the indications for ovarian grafting resolve themselves then into the consideration of the maintenance of the ovarian function only when it is impossible to leave an ovary or part of an ovary in the normal site during the reproduc-

tive period—that is in patients before the age of 45 years or thereabouts. Such an eventual ity is usually produced by genital infections of an ascending type principally gonorrhœal. It will be seen from the table that salpingo oophoritis was the primary lesion necessitating ovarian transplantation in 96 per cent of my cases and that excluding puerperal salpingo oophoritis and infections associated with other lesions ascending infections of gonorrhœal origin produced the primary lesion in approximately 82 per cent of all my cases. In Tuffier's series of 230 operations the primary lesion was unqualified salpingitis in only 61 per cent.

The literature has however been so admirably analysed up to the end of 1921 by Franklin Martin (4) that those interested in a general survey I would refer to his paper. Here I am concerned in giving an outline of my own practice.

To resume it should not for a moment be imagined that because the case is one of salpingitis the ovaries must be transplanted; this is far from being the case. Often it is possible for the surgeon to cut through the mesosalpinx and to remove a diseased tube without injuring the ovarian blood supply (Fig 1 B). When however there is a large pyosalpinx the two layers of the mesosalpinx may be widely separated and any attempt to excise the tube alone leads to interference with the ovarian vessels (Fig 1 C). It is this that causes the ovary if it be retained in the pelvis to undergo cystic degeneration; that is to say dehiscence of ripe follicles does not occur.

In fibromyomatous disease of the uterus when there is no associated salpingitis it is almost always possible to conserve one if not both ovaries and I disagree entirely with those who assert that the ovary is a useless appendage in the absence of the uterus. Nevertheless if the uterus or a portion of it can be preserved this should always be done in the surgical treatment of fibromyomata uteri and pelvic infections. It was to meet this requirement that I devised what is now generally known as the Bell Beutner operation for lesions produced by ascending infections whereby a transverse wedge shaped portion

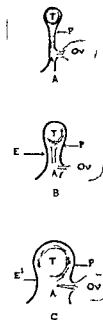


Fig. Diagram showing the danger to the ovarian blood supply upon removal of the fallopian tube for salpingitis. O = ovary; T = tube; P = peritoneum; A = ovarian artery.

A. Relation of the normal tube and ovary. The mesosalpinx is long and in it run the tubal branches of the ovarian artery.

B. Salpingitis has produced moderate enlargement of the tube. In such a case salpingectomy through the mesosalpinx at the point E would necessitate division of the tubal branches of the artery but would leave unaffected the ovarian artery itself.

C. Salpingitis has produced a pyosalpinx with considerable enlargement of the tube and consequent obliteration of the mesosalpinx. Salpingectomy at this point F would inevitably interfere with the ovarian blood supply.

of the infected fundus uteri is removed along with the tubes (1).

Bilateral innocent cystic neoplasms are comparatively rare although it is a very common occurrence for the gynaecologist to see several retention follicular cysts of the same size as that of a plum in both ovaries but these can almost always be excised without the necessity of removal of the ovaries.

#### TECHNIQUE OF OVARIAN GRAFTING

When the surgeon has decided that it is impossible safely to conserve any ovarian tissue in the normal position the next consideration arises in regard to the best method of implantation. Here let me say that it is generally



Fig 2 Has ng been cut up in crisscross fashion with sharp knife on rubber plate to maintain tissue vitality for grafting

conceded that to secure a functional result the procedure should always be autoplasic that is to say ovarian tissue from the patient herself must be transplanted Homoplastic grafting with ovarian tissue from another woman is very rarely effectual and heteroplastic ovarian implantation with tissue from another animal is useless

The ovarian tissue removed is separated from other structures such as the tube and a long silk thread on a sharp needle is passed through it The two ends of the thread are knotted together and the ovary so tethered is placed in the pouch of Douglas or elsewhere in the peritoneal cavity the ends of the thread being brought through the laparotomy opening and held in a pair of forceps In this way the ovarian tissue is kept moist and warm in natural surroundings until required for grafting

When the operation for the primary lesion has been completed but before the laparotomy wound is closed the ovary is recovered by withdrawing the thread attached to it and is placed on a small square of rubber 6 inches in diameter and about  $\frac{3}{4}$  inch in thickness which has been sterilized in readiness A very sharp grafting knife is taken and the hard cortex is shaved off the ovary or pieces of ovary as the case may be Then by a series of crisscross incisions the whole piece of ovary is divided into small parts which are still held together by the underlying layer of tissue (Fig 2) It is merely for convenience in handling that the ovary is not cut into separate fragments The exposure of such a large area of surface and the limited size of the fragments tend to ensure rapid vascularization of the implanted tissue There is also less chance of follicular cyst formation

Next the aponeurosis covering the rectus on one side of the laparotomy incision is seized with a pair of compression forceps and

drawn towards the operator who with a knife carefully makes a small incision through the upper surface avoiding all vessels The blunt point made by the closed blades of a long angular compression forceps is passed through the opening in the rectus sheath and gently forced into the body of the rectus muscle parallel to the surface The blades are then slowly separated (Fig 3) It is most important that there be no bleeding for although grafts must be implanted in vascular areas if the grafted tissue is bathed in blood it cannot become attached to the surrounding structures from which nutriment is to be drawn The ovarian graft is now passed into the middle of the muscle and laid flat among the fibers The edges of the opening in the rectus sheath are brought together with a couple of sutures and the laparotomy wound is closed

If the infection in the pelvis be recent and drainage is considered advisable a tube is passed through a stab wound outside the rectus muscle to the bottom of the pouch of Douglas and in these circumstances the ovarian implantation is made in the external oblique muscle close to the drainage tube

I have also grafted the ovarian tissue into the uterus or into what was left of the organ and I have wrapped it in the free border of the omentum But considering the ease with which the whole procedure just described is performed and the advantage of the site for subsequent observation implantation in the rectus muscle which satisfies the requirement of vascularity is preferable to grafting elsewhere

#### AFTER HISTORIES AND RESULTS

In spite of the fact that the greatest care has always been taken to secure adequate information concerning the after histories of patients subjected to operation in my department and in spite of the additional interest

taken in securing the attendance of or replies from the one whom new procedures have been practised it appears to become increasingly difficult to secure co-operation on the part of hospital patients who are a shifting population. In a previous enquiry (2) it was found impossible in 20 per cent of all cases to secure after histories. In the table given here which includes the cases previously reported it will be observed that after histories have not been obtainable in 30 per cent of all cases subjected to ovarian grafting.

After the ovaries have been completely removed from the normal position and even though ovarian tissue has been transplanted there is a period between the operation and the time when the graft has become completely vascularized and is supplying internal secretion to the host during which the patient may suffer with all the physical and psychological disturbances of the menopause. The duration varies from 1 to 8 months after operation. The average time is about 4 months and as soon as the transplanted tissue becomes fully functional these disturbing symptoms disappear often coincidentally with the reappearance of menstruation if that be possible.

I have sometimes prescribed ovarian and thyroid substances when this temporary menopause has given rise to severe manifestations but this is rare.

In the table it is shown that in the whole series analysed functional results were obtained in 83 per cent of the cases. In figures of about half of the whole number published in 1920 (2) the functional results recorded reached 80 per cent. It appears therefore that by the method practised functional results may be expected in a little over 80 per cent of all cases.

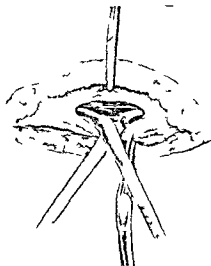


Fig. 3. Method of preparing a bed in the rectus muscle for the ovarian graft.

#### TOTAL NUMBER OF CASES EXCLUDED 69

- |   |   |    |
|---|---|----|
| A | Operated within 6 months                                | 9  |
| B | ( ) Died after operation (Mortality rate 1.07 per cent) | 2  |
|   | ( ) Had edema of other causes                           | 2  |
| C | Failure to obtain complete after histories              | 56 |

#### TOTAL NUMBER OF CASES ANALYSED 118

- |   |  |            |
|---|--|------------|
| A | Total cases in which menstruation was possible                         | 97         |
|   | Menstruation occurred in   | 71 (66.3%) |
|   | Menstruation in menopause  | 26 (26.6%) |
|   | Menstruation and menopausal symptoms                                   | 15 (14.0%) |
| B | Menstruation impossible owing to supragenital or complete hysterectomy | 21         |
|   | Menopausal symptoms  | 6 (54.5%)  |
|   | Menopausal symptoms  | 5 (45.5%)  |
| C | Functional results in  | 98 (83.0%) |
|   | Failure to obtain functional results in                                | 2 (17.0%)  |

By functional results we mean that the symptoms of the menopause are abolished at any rate after the first few months following operation and do not reappear for some years.

It will be noted also that in those patients in whom a portion at least of the uterus was conserved—usually by the Bell Beuttner procedure—menstruation reappeared in no less than 66 per cent. This is the same percentage for the whole as obtained in the first half of my cases consequently it may be confidently anticipated that menstruation can be conserved in this large number of all cases.

#### TOTAL NUMBER OF CASES RECORDED 187

Indicated by graft

- |   |   |   |
|---|---|---|
| A | Salpingo-oophoritis—13                                |   |
|   | Primary lesion (1 of 14 cases of puerperal infection) | 5 |
|   | Associated pyelitis                                   | 4 |
|   | With fibromyomata                                     |   |
|   | With tubal gestation                                  |   |
| B | Endometrial neoplasia—13                              |   |
|   | Endometrial   | 4 |
|   | Other neoplasms of both ovaries or of remaining ovary | 9 |
| C | Ovarian neoplasia with functionless uterus            |   |

I need not urge the importance physiological and psychological of menstruation to the woman who is normally feminine a qualification unfortunately necessary in these days.

Menstruation when it appears may be quite regular for many years. A number of my patients are still menstruating normally and regularly 2 years after operation. On the other hand some menstruate irregularly and scantily and may cease to have their catamenia after a few months or after menstruation for a year or two but in these the subsequent menopausal symptoms are slight if present at all. Such results may therefore be claimed as final. In this matter age may be of importance. I cannot expect the ovaries in a woman of 40 years of age to function so well as those of younger women yet I notice among my cases one woman of 40 years of age who menstruated more or less regularly for 3 years.

With regard to the graft itself it is frequently resented in my series that peritoneal swelling with pain and tenderness occurs. If however the cause of this be explained to the patient he always prefers to suffer this slight inconvenience rather than have the graft removed. One woman explained her anxiety to continue menstruating on the ground that he wished to marry. She as in fact are many women was under the impression that a woman should not marry unless she is able to menstruate. This experience alone would have been an incentive to me if I had had no other to endeavour to perfect the technique of ovarian grafting.

Sometimes it has happened twice in my series a small follicular cyst forms in the graft and causes abscess when the ovary is normally situated menorrhagia or ep-

menorrhagia. It is a simple matter when the tube is grafted in the rectus to cut down under local anaesthesia and remove the cyst. Similar experiences have been recorded by Miller (5) Lack (3) and others.

My conclusions regarding ovarian grafting have been given on previous occasions and have been set forth by Franklin Martin in the paper to which I have referred. I shall therefore content myself by repeating that in my opinion the question of the employment of ovarian grafting is of reference to the so-called clean sweep is no longer open to discussion ovarian transplantation a procedure no scientific gynaecological surgeon can afford to neglect. It only remains for us to select the proper case and endeavour so to perfect the technique that in the future we may progress even more definitely than we can to a successful result. In spite of the fact that there are those who are bold enough to say that they have never seen any bad menopausal symptoms follow complete removal of both ovaries in young women we must pursue our goal which we ourselves may never reach in order that those who follow after may convert them into realities.

I am indebted to Dr S. P. H. Morgan and friends at The Royal Infirmary for the last and anxious 12 months of the patients.

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ONE THOUSAND OPERATIONS FOR GASTRIC DUODENAL AND JEJUNAL ULCERS<sup>1</sup>

By DR VICTOR PAUCHET PARIS FRANCE

Surg. t St M h l Hospital

**D**URING the past 25 years I have performed one thousand operations for gastric duodenal and jejunal ulcers divided as follows 367 for gastric ulcer 336 for duodenal ulcer 38 for gastric and duodenal ulcer combined 39 for postoperative jejunal ulcer

Operations for hour glass stomach are included in the above but I have omitted 33 operations for acute perforation of gastric and duodenal ulcers

## GASTRIC ULCER

The immediate mortality was as follows gastro-enterostomy alone for duodenal ulcer 1 case 2 per cent gastrectomy for duodenal ulcer 2 cases 5 per cent resection for gastric ulcer in proximal third of lesser curvature 9 per cent resection for ulcer in the prepyloric portion or in the middle third of the lesser curvature 1 case 4 per cent

Prior to 1905 I limited my intervention to gastro-enterostomy with a mortality of 8 per cent From 1905 to 1910 a wedge shaped excision of the ulcer bearing area alone was done with a mortality of 20 per cent Since 1910 i.e. for the past 15 years I have performed 367 operations for gastric ulcers Of these there were 20 Balfour operations 4 gastro-enterostomies 18 annular (sleeve) resections and 327 gastrectomies (gastropylorectomies) after primary division of the duodenum When speaking of gastric ulcers reference is always to those of the lesser curvature because I have never observed one at any other portion of the stomach

The term pyloric ulcer is a misnomer because in reality they are either duodenal or gastric (when the latter they are near the pylorus)

The end results of gastric ulcer operations are better when one removes a large portion of the stomach The more one resects the greater the percentage of cures

In 18 sleeve or annular gastric resections a cure was obtained in only 3 cases after an extensive gastrectomy

The Billroth I method is my first choice but whenever this cannot be performed I resort to the Polya method The Billroth II has never been employed In 4 cases a secondary operation was necessary after the Billroth I because the duodenum was stenosed I limit the Billroth I to cases in which the duodenum is relatively large When this is not the case I always employ the Polya method

In very high lying ulcers a total gastrectomy was performed in 5 cases while in 21 cases I resected the lesser and three fourths of the greater curvatures a method to which we apply the term resection *en gouttiere* This method is followed by the most satisfactory end results

In 2 cases there was a recurrence after the Balfour method and we were obliged to do a secondary subtotal resection which was followed by complete relief of symptoms Microscopic examination of the specimens in these 2 cases revealed evidences of malignancy It may be of interest to add that we have found typical carcinomatous changes in 15 per cent of 200 consecutive gastrectomies for ulcer which were subjected to microscopic examination

Gastropylorctomy (practically a subtotal resection) is the operation of election in gastric ulcer for the following reasons

1 Because it eliminates bleeding pain gastric symptoms and the chances of malignant degeneration

Local resections like those of Balfour or gastro-enterostomy alone do not prevent a recurrence We have never observed such an end result after gastropylorctomy

## DUODENAL ULCER

In a total of 336 operations gastro-enterostomy alone was performed in 213 cases During

<sup>1</sup> Prepared for presentation before Clinical Congress of American College of Surgeons October 6-13-1935 Not read because of illness

recent years I have either added cautery puncture and subsequent infolding of the ulcer bearing area to the gastro enterostomy or I have employed the Finney operation. For the latter considerable mobility of the stomach is necessary otherwise the method may be fraught with danger.

In 130 cases of duodenal ulcer gastrectomy with resection of both the duodenum and stomach has been done. Thus has also been our practice in cases of combined gastric and duodenal ulcers.

Gastro-enterostomy alone is ideal in cases of fibrous duodenal stenosis when there is no hyperchlorhydria and the ulcer is latent.

In cases of duodenal ulcer associated with gastroptosis the Finney method gives the most satisfactory end results.

When the duodenal ulcer is in an active stage and the acidity normal we prefer cauterization followed by infolding of the ulcer bearing area and a gastro enterostomy. If however there is marked hyperacidity we believe that only an extensive resection of the stomach and involved portion of the duodenum should be done.

Gastropylorctomy for duodenal ulcer is more difficult technically than for gastric ulcer. This is especially true when the duodenal stump is adherent to the pancreas.

We have never found microscopic evidence of malignant changes in duodenal ulcers.

One should never fail to examine the biliary tract in operation for gastric or duodenal ulcer. Cholecystectomy or drainage as the case requires can be done at the same sitting as the other operations.

An appendicectomy is done as a routine measure.

It is very important to give the patient a

proper diet and to follow the case for a year at least. Care of the mouth, teeth, tonsils, nose and of constipation is not to be overlooked. Tobacco is to be avoided and the following articles of food reduced to a minimum: meats, fish, eggs and milk.

#### JEJUNAL ULCER

When we performed gastro enterostomy alone for duodenal ulcer a jejunal ulcer was observed at the stoma in 5 per cent of the cases. Since we have changed our type of operation for duodenal ulcer as described in the preceding portion of this paper we have not seen a single jejunal ulcer in our cases. The only jejunal ulcers found by us at operation in recent years were in patients operated upon by other surgeons.

In none of these had a radical gastric resection been performed.

A gastropylorctomy was the method of treatment in 39 jejunal ulcers with 4 deaths. We have resected the major portion of the stomach including the gastrojejunal stoma. Such a subtotal gastrectomy is the method of choice to prevent recurrence. In 35 of 38 cases the patient was cured.

The most serious complication of a jejunal ulcer is a gastrojejuno-colic fistula. In order to save the patient's life an operation should be done as soon as the condition is even suspected. The mortality of a separation of the viscera and closure of the openings is still very high. We have been most successful with the following procedure: resection *en bloc* of the stomach and colon segments of the fistula if possible without opening the lumen of both viscera. In our hands the mortality of operations for such fistulae has been very high, namely 30 per cent.

## CONGENITAL STRICTURE OF THE URETER

REPORT OF FOUR CASES<sup>1</sup>

By HERMAN L. KRETSCHMER, M.D., F.A.C.S., CHICAGO

NO subject is receiving as much discussion and no subject occupies the center of the urological stage so prominently as does the subject of stricture of the ureter in adults. This is due primarily to the enthusiasm and untiring work of Hunner who by his many contributions has aroused the interest of urologists in all parts of the country. By reason of the widespread interest and the ample opportunity to study this lesion it will not be very long before the entire subject of stricture of the ureter in adults will be upon a firm basis and become so well stabilized that many of the disputed and doubtful questions will be cleared up.

Congenital strictures or so called congenital strictures it should be emphasized are not so easy to study and the cases are apparently not so numerous as are the ordinary cases of stricture of the ureter. As can readily be understood the cases occur in children and they are not referred to the urologist for study. Moreover the condition is often not recognized and it is necessary to use the cystoscope and to make pyelograms in all cases for which the consent and co operation of the parents are very difficult to obtain.

There is today in the literature on this subject a great deal of confusion and a lack of clarity in the description and case reports. A perusal of the literature shows that many cases are reported as cases of congenital stricture and no reason or reasons are given by the author or authors that they are reporting a case of congenital origin. It is difficult to understand by what method of reasoning a case of stricture of the ureter with a hydro-ureter and hydronephrosis occurring in an adult of 30, 40, 50 or even 60 years should be classed as a case of congenital stricture. The classification of many of the cases of so called congenital stricture of the ureter surely needs revision particularly that group which has been classed as congenital and reported late in life.

The arbitrary age of 5 has been selected by some who believe that all these cases manifest themselves before the age of 5. Whether or not this is true remains to be seen.

On account of the arbitrary classification in the literature it is with some hesitation that I venture to report 4 cases of so called congenital stricture of the ureter the oldest patient being 5 years of age and the youngest 7 months.

The etiology is obscure and difficult to determine. As is well known the ureter early in embryonic life consists of a solid mass of epithelial cells which later undergo canalization to form the lumen. If there is interference with this process obstruction may result. Whether or not this would go on to true stricture formation or whether these cases are the result of an intra uterine infection I am not prepared to say for the question of intra uterine infection is one that has not as yet been definitely determined. Are these strictures acquired through some sort of infection other than intra uterine? This indeed would be difficult to demonstrate.

CASE 1. R. F. male age 7 months was referred by Dr. John De Witt of Canton, Ohio.

The present complaint was swelling of the right side of the abdomen which had been present for 5 months. When the patient was 2 months old the mother noticed that the right side of the abdomen was much larger than the left side. As there were no untoward symptoms the mother dismissed the matter from her mind thinking that her imagination was to blame. However on several occasions during the next 3 months she again noticed this swelling. One month ago on account of the increasing size of the swelling a physician was consulted. The patient had had attacks of fever on several occasions during the past month.

The patient had been delivered normally. According to the mother's statement the baby did not cry nor fret more than any normal child.

*Physical examination.* The patient was a slightly emaciated somewhat anemic appearing child lying quietly in bed. Examination of the abdomen showed the presence of an enormous swelling in the right upper quadrant of the abdomen. It was relatively smooth, soft and mobile. Examination of the mass





developed the present attacks which have persisted. They occurred on an average of once a week and lasted for about 2 days. In the interval the child was perfectly well. The attacks became much worse with increased frequency. The pain very severe in character and associated with nausea and vomiting was located chiefly in the upper left quadrant of the abdomen. During attacks the patient's temperature rose to 103 degrees. Examination of the urine in an attack 6 months previously showed blood and pus. Because of recurring attacks of chills and fever associated with pus in the urine the child had been treated for acute pyelitis before he was seen by Dr Jager.

General physical examination showed the head, neck and chest to be normal. Examination of the abdomen revealed a very large tumor mass in left upper quadrant the size of a large grapefruit not tender and freely movable. The genitals were negative. Examination of the blood showed leucocytes 8400, hemoglobin 92 per cent.

Cystoscopic examination on February 24, 1923 showed the bladder normal and the ureteral openings normal. Both ureters were catheterized without difficulty or obstruction. From the left kidney a prompt flow of very turbid urine was obtained. The right urine was clear. The catheterized urines were as follows:

	Leucocytes per milliliter	Culture	Tuber- culosis	U
Bladder	62	Sterile	Negative	15 per cent
Right kidney	49	Sterile	Negative	13 per cent
Left kidney	1120	Sterile	Negative	1 per cent

#### PHENOLSULPHONEPHTHALEIN TEST

	Right 5 minutes	Left No thalein from left side
Appended		
First 30 minutes	25 per cent	
Second 30 minutes	19 per cent	
Total 1 hour	31 per cent	

Examination by Dr Grulee revealed a soft systolic murmur over the apex which he thought was an adventitious murmur.

Blood chemistry showed urea .38, uric acid .28, creatinin 1.1, non protein nitrogen .30.

A pyelogram of the left side showed the catheter extending to the fourth lumbar spine then making an abrupt lateral curve to the left and stopping about 2 inches from the spine. A film made while the tumor mass was being pushed medially showed the kink in the catheter overlying the lumbar spine and the tumor mass pushed considerably toward the midline. The pyelogram showed a large round shadow that extended from the twelfth rib above to the lower border of the fourth lumbar vertebra below and from the middle of the spine to a line drawn from the tip of the eleventh rib to the crest of the ilium. There was an enormous dilatation of the kidney pelvis and enormously enlarged clubbed calyces. The kidney pelvis measured 8.5 by 9.5

centimeters. Each of the calyces was approximately 3 centimeters in diameter and five were shown (Fig. 3).

A diagnosis of hydronephrosis due to stricture was made.

At operation March 6, 1923, under general anesthesia a left lumbar nephrectomy was performed. The usual oblique lumbar incision was made and the kidney delivered without difficulty. The pelvis was enormously enlarged. At the uretero-pelvic junction a stricture of the ureter was found. The vascular pedicle was ligated and cut and the ureter was ligated and divided and removed below the point of stricture. The postoperative course was uneventful.

Description of specimen. The kidney and empty pelvis weighed 52 grams. The kidney was 9 by 3.5 by 2.5 centimeters. The collapsed pelvis was 5 by 4 centimeters. The capsule of the kidney had been stripped off and the surface was red, finely granular and also showed marked *fetal lobulations*. The pelvis was attached to the kidney along the entire length of the concave surface; it was thin walled and white and the ureter rose abruptly at its lower distal and anterior aspects. There was a distinct stricture 5 centimeters below the origin of the ureter. The average diameter of the ureter was 3 millimeters while that of the stricture was 1 millimeter. Two arteries and a vein entered the kidney anterior to the pelvis at the junction of the upper and middle two thirds. No aberrant vessels were present. On opening the ureter and pelvis we found the lining throughout smooth, glistening and shining. There were no areas of leucoplakia. A septum at the level of the large vessels partially divided the pelvis into upper and lower cavities. The walls were uniformly 1 millimeter thick. Section of the kidney showed greatly dilated calyces and thinning of kidney tissue. The average thickness of kidney tissue was 5 millimeters, half of which was medulla and half cortex (Fig. 3).

Microscopic examination showed generalized infiltration of the kidney substance with round cells and polymorphonuclear lymphocytes with areas of fibrous tissue replacement. The sections of the wall of the pelvis were in relatively normal condition except for slight round celled infiltration.

CASE 3. T. H. male age 3 years was referred by Dr. B. W. Sippy. At the age of 22 months the patient was suddenly seized with chills and fever, the attack lasting about 1 week. Temperature at the time had varied between 104 and 105 degrees F. There were frequent vomiting spells. Several months later there was a recurrence of the attack which was followed by a swelling on the right side in the region of the right kidney. This was incised and drained and a large quantity of pus was evacuated. Frequency of urination began after the operation, voiding being peremptory every 2 or 3 hours at night. There was pus in the urine. At the time of operation a tube was inserted into the kidney and so long as the tube was in no urine was passed from

the bladder. The father had been told that the boy had only one kidney.

It may be possible that the boy had a bilateral condition and a status similar to that presented in Case 1.

Examination revealed a scar on the right side in the right lumbar region with some tenderness.

Examination of blood showed 14,000 leucocytes. The X-ray was negative for stone.

Cystoscopic examination September 17, 1921, showed a normal bladder with left ureter absent. Two subsequent ureteral catheterizations failed to show the presence of a left ureteral orifice. Under anesthesia the results were no better. The right ureter was catheterized and a pyelogram made (Fig. 4).

Examination of the urine obtained at the cystoscopic examination as follows:

	Cell	Culture
Bladder	720	Staphylococcus albus
Right kidney	480	Staphylococcus albus
Left kidney	Not catheterized	

The pyelogram showed an enormously dilated ureter, enormously dilated kidney pelvis and very much enlarged superior and inferior calyces. The fluid in the ureter terminated very abruptly opposite the upper margin of the hip joint. From these findings a diagnosis of stricture of the ureter with an infected hydro-ureter and hydronephrosis was made.

**CASE 4.** M. M. female, age 7 months. Shortly before coming under observation the patient had had an attack of influenza, so called, after which pus was present more or less in the urine. The gastrointestinal symptoms had manifested themselves in 4 or 5 bowel movements a day. Digestion was poor. The temperature rose as high as 103 degrees. Culture of the urine revealed pure culture of *Bacillus coli communis*. Treatment had consisted of bicarbonate of soda, sodium citrate and vaccines, but the improvement was only temporary. There had been recurrent attacks of fever, nausea and vomiting, the temperature rising to 103 degrees F.

The physical examination was negative.

Cystoscopic examination October 24, 1919, showed some urædema at the base of the bladder and trigone, the ureteral orifices normal, and a few small cysts in the bladder. The passage of a catheter up the left ureter met with some obstruction.

Urinalysis of urines obtained by ureteral catheters showed a few pus cells, and cultures were positive for bacillus *coli*. Stained sediment was negative for tubercle bacilli.

Pyelograms were made which showed a marked degree of enlargement of the right kidney pelvis with clubbing of the calyces and broadening of their bases. The pyelogram on the left side showed only a moderate amount of enlargement of the pelvis.

The interesting phase of this subject aside from the etiology concerns itself with the

problem of the early diagnosis so that the proper form of treatment may be instituted. That this lesion is not so rare as one would be inclined to think is evidenced by the fact that Bottomley in his very extensive monograph on this subject was able to collect 23 cases that occurred in children under the age of 5. His cases were nearly all autopsy cases and while a few of these patients died from intercurrent diseases, most of them died as the result of the urinary tract lesion.

Bugbee who recently reported a large series of congenital anomalies of infancy and childhood affirms as the result of his investigations that less than one third of the infants who had hydronephrosis lived over 6 months.

The gravity of the lesion of course is less severe when it occurs only on one side, but a review for example of Bottomley's cases shows that out of 23 cases 5 were bilateral. One case in my series of 4 was bilateral.

There seems to be but little difference in the frequency with which the right or left side is involved. And the same statement may be made regarding the frequency of occurrence in sexes. There is so little difference in the figures of diagnostic moment that one obtains little help from these factors.

A number of cases are reported in the literature but they are autopsy reports. Evidently during life the symptoms did not lead the clinician to suspect a congenital stricture of the ureter. Even in those instances in which there is mention of the symptoms the fact stands out that the clinician did not focus his attention on the higher urinary tract but was in a state of doubt as to the real cause of the disturbance and was more or less mystified as to the cause of death.

Another fact to be borne in mind is that most of the cases were reported in the older literature at a time when these little patients were not given the benefit of a careful and complete urological survey. Even today the problem with which urologists have to contend is the lack of opportunity given them to examine these patients carefully and the result is that the patients come to autopsy all too frequently without a clear determination of the exact pathology present. It is not difficult to understand just why this should be

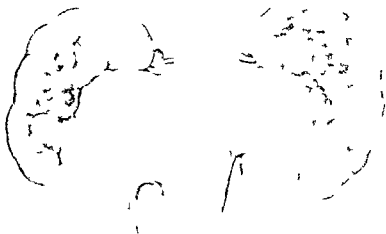


Fig. 1. Case 1. Shown in the present illustration is the condition of the urinary tract in the case of bilateral congenital stricture of the ureters. The stricture is shown in the left and right ureters.

the case when the symptoms point but vaguely to stricture of the ureter or when lesion of the urinary tract are suspected. Surely the only measure that will result in a correct diagnosis is a complete urological examination. That the clinical picture is not always typical and the symptoms at times are those of acute infection are points in favor of a thorough urological examination. In one of the cases reported here the treatment was the ordinary one for acute pyelitis.

#### BILATERAL STRICTURES

According to Mufson only 8 cases of bilateral congenital stricture have been reported to which he adds 1 of his own. Wason has recently reported a case of bilateral stricture in a male 7 months of age. Doubtless as this subject receives more careful consideration and these cases are observed more closely a larger number not only of single but of double strictures will be reported.

One of the patients in this group (Case 1) had bilateral strictures which were found at autopsy, the condition (bilateral) not having been recognized clinically.

Case 3 in which we were never able to find a left ureter and in which no urine came through the bladder when the kidney on the opposite side was drained would suggest the probability that the patient had bilateral strictures, one of which had completely closed, causing complete destruction of the kidney, a condition which occurred in Case 1 in this series.

In one of the cases the patient was sent in because of the presence of a large abdominal tumor with a tentative diagnosis of tumor of the kidney probably malignant. In the remaining cases because of chills, fever and pus in the urine the patients were sent in with a diagnosis of acute pyelitis.

Doubtless an attack of acute pyelitis may mask some of these cases of so called congenital stricture of the ureter and it might be interesting to study a large series of cases of pyelitis which come to autopsy to determine whether or not they were simple cases of pyelitis or cases of congenital stricture. In other words, would one in this way pick up more cases if one followed all cases of acute pyelitis to the autopsy table? There is no

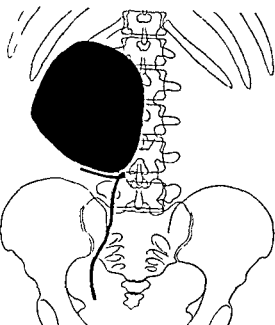


Fig 1 Case 1 Large hydronephrosis due to stricture of the ureter pelvis from the tip of the iliac fossa to the iliac crest

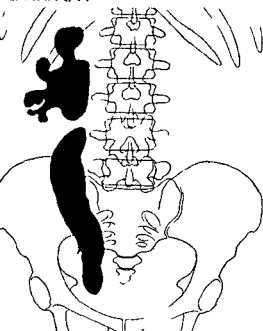


Fig 2 Case 2 Shifting position of the hydronephrosis due to stricture of the ureter pelvis from the tip of the iliac fossa to the iliac crest



Fig 3 Case 3 Shifting position of the hydronephrosis due to stricture of the ureter pelvis from the tip of the iliac fossa to the iliac crest

doubt that some of these patients whose cases end fatally during attacks of acute pyelitis may have been suffering from an infected hydronephrosis secondary to stricture of the ureter. Occasionally there is a very sudden and stormy onset so that the condition is confused with the so called surgical abdomen and in operation for acute appendicitis performed. So long as the hydronephrosis remains uninfected and a palpable tumor is not found the condition is not suspected. When the hydronephrosis remains stationary and does not become infected the clinical course is febrile. In case a tumor is present and varies in size as occurred in one of these cases the diagnosis should be relatively easy. The condition has also been confused with malignant renal tumor.

The problem of diagnosis was interesting in Kahn's case in which the diagnosis was obscured by a history of intestinal obstruction. A megacolon had to be taken into consideration as well as a tuberculous peritonitis.

It should be emphasized that urinary findings may give no intimation of the condition present in the kidneys. Another point of importance to remember is that absence of symptoms pointing to the ureter as the source of the trouble especially in acute cases makes a definite diagnosis of ureteral stricture at times very difficult before operation.

Because of the relative frequency of bilateral lesions the data on the opposite kidney should be carefully looked into. It would have been very easy and very simple in case I had carried out a nephrectomy which doubtless would have shortened the patient's life.

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## A NEW AND SIMPLE REPAIR OF RUPTURED OR STRICTURED URETERS<sup>1</sup>

By L. L. McARTHUR M.D. F.A.C.S. CHICAGO

#### SUMMARY OF CASE

AS I have demonstrated since 1907 with increasing satisfaction to myself and my patients the feasibility of restoring the integrity of the common bile duct together with its function when portions were missing or strictured I have been watching for years for an opportunity to apply the same principles to other excretory ducts such as the ureter, urethra and salivary duct. Finally in April 1923 I used the method here presented with such gratifying results that I feel justified in inviting your attention to the case in question, the X-ray findings and the method which once clearly understood will appeal to you as worthy of trial.

If in an active surgical service of two of our largest hospitals one has to wait over 10 years for an appropriate case it will be readily seen that no one surgeon could report a series. In fact Morris could collect but 4 cases of traumatic rupture of the ureter in the literature. However should such a case come to one of you the knowledge that there still remains a recourse simple of performance and of demonstrated value should prove a source of mental comfort. To the patient it will mean the salvation of a kidney sacrificed at present to avoid a permanent urinary fistula.

August 28, 1922 the patient was knocked from a wagon seat by a collision and the left side of the body struck a stone curbing. X-ray pictures taken when he arrived at the hospital revealed fracture of the left three lower ribs and the left transverse processes of the second and third lumbar vertebrae. Shortly after the accident he developed a severe constant pain in the left renal region, a gradually enlarging tumor mass in the left side. These two symptoms persisted until November 19, 1922 when he was operated upon at the Masonic Hospital, Chicago. He was told he had had water on the kidney and that 2 quarts had been evacuated. Since then there had been a persistent urinary fistula with free flow of urine saturating heavy dressings twice daily. When he was admitted to St. Luke's the physical examination was negative except for a palpable mass in the left kidney region and a fistula. A ureteral catheter on the left side met with resistance at 4 centimeters from the ureteral orifice.

The X-ray showed the fractures mentioned and a tumor shadow (kidney?).

The laboratory reported the urine negative red and white corpuscles and haemoglobin normal and phenolphthalein output from the right kidney 50 per cent in 4 hours. No Wassermann was made.

Diagnosis: Obstructed ureter and urinary renal fistula.

Operation: April 20, 1923 by L. L. McArthur at Clinic given for the visiting Detroit Surgical Society. Reopening the former renal incision the kidney was found rigidly fixed by the prolonged and excessive infiltration with a fibrous or fatty capsule.

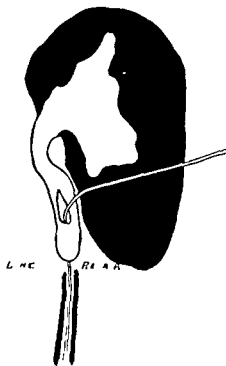


Fig. 1. Schematic diagram of the repair of the case reported.



Fig. 2. Actual position of the catheters in the patient as shown by X-ray.

so that attempts to bring the kidney to the surface were abandoned. Attention was then directed to the ureteral outlet. Just below the lower pole a translucent fluctuating tubular structure was found of lead pencil size 2 inch long terminating in a blunt extremity. Believing this to be a dilated ureter a longitudinal incision was made in its side clear urine escaped followed by cloudy mucopurulent fluid and a flexible probe as readily passed into the renal pelvis. After considerable search the dilated portion of the ureter was found. A very atrophic after 9 months in use but admitting a ureteral catheter which could be passed its full length into the bladder. The end of the ruptured ureter which had evidently been sealed by the formation of scar tissue and the dilated tubular structure processes could be approximated to within 1 inch of one another.

The situation and finding were reported to the attending surgeons present and concluded that the only recommendation offered was *medical nephrectomy*. I then proposed that attempting the technique by which common duct repair had proved successful but met no encouragement. The ends of the ureters were situated sufficiently to make excision of the scar tissue. Through the longitudinal slit in the side of the proximal fragment of the ureter an ordinary

soft rubber No. 6 urethral catheter was passed well up into the pelvis of the kidney and its free end brought out through the wound to the surface of the body. Through the same longitudinal slit in the side of the proximal fragment of the ureter the tip of a 1/2 sized ureteral catheter was passed downward out of the freshened end and then on into the freshened end of the distal fragment down all into the bladder its free funnel end also being brought out of the wound beside the catheter. The gap between the ureteral ends diminished by sutures to about 1/2 inch. Both catheters were fixed by sutures to the lumbar skin flaps and the wound closed. Drainage of the kidney was so perfect that the hemorrhage subsided speedily. The urine from the left kidney collected in a rubber glove in which renal drainage continued during 9 weeks with no malodorous discharge abundant. At the end of 9 weeks both catheters were removed. The removal of the catheters was followed by the wound immediately healed. The quantity of vesical urinary output doubled. The patient was shown to the Chicago Surgical Society 9 months later perfectly well objectively and subjectively with no pain and no recurrence of the tumor. The patient was still in perfect health when she was examined November 7, 1924.

## TECHNIQUE

Given a missing portion of a ureter even 1 to 2 inches in length a longitudinal slit is made in the side of the *proximal* portion sufficiently long to admit two catheters. One of these a rubber urethral catheter is inserted upward to the renal pelvis the second a *ureteral* catheter of good size is inserted downward so that it passes out of the proximal end and bridges the gap to the proximal end of the distal remaining ureter. Both ends of the ureters are then approximated as closely as feasible by absorbable stitches. The catheters are then brought to the surface and permanently secured to the skin by stitches or other devices. All the urine from that kidney is thus diverted from the field of operation during the time of epithelization. The body tissues heal together around the catheter bridging the gap between the renal end and vesicle end and the catheter simply remains *in situ* until in the judgment of the operator an epithelial lining has had time to grow between the ends. No experimental work along these lines has determined the *time* element but that epithelization *does*

occur has been amply demonstrated in the various reconstruction methods that have proved successful. We owe much to Strauss for a method of securing epithelization. Thus in the specimens of Strauss (tubular fascial grafts) the epithelium is plainly to be seen though of the flat pavement variety. Knowing that fascial tubes would thus become lined with epithelium I thought epithelization would occur equally well without transplants provided I maintained a tunnel long enough for epithelium to grow from each end to line it and for the primary inflammatory reaction and contraction to subside. I could then withdraw the catheters from both ends and have a channel lined with epithelium that would permit the flow of urine. This had proved successful with several common ducts and has now been demonstrated as similarly efficient for ureters.

Whether the missing portion of the ureter is lacking by accident or design (as because of malignant disease) when the ureter is too short to be implanted in the bladder the above technique can be applied with safety and success.



PNEUMONOGRAPHY<sup>1</sup>

By LOUIS H. CLERF, M.D., PHILADELPHIA

F m th B hosc p Cl Ph lad lph

EVER since 1905 when Chevalier Jackson first used a radiopaque substance for outlining the tracheobronchial tree the value of pneumonography as a diagnostic aid has steadily advanced. The rapid progress made in the field of roentgenology during the past decade has contributed immensely to correct diagnosis and localization in diseases of the lungs. In certain cases however a correct interpretation of the roentgen ray findings is difficult without resorting to pneumonography that is increasing the visibility of the tracheobronchial tree by the intrabronchial introduction of a material which is opaque to the roentgen ray.

In 1905 Chevalier Jackson conducted a series of experiments on the use of radiopaque substances in the air passages and presented some of his results before the Pittsburgh Academy of Medicine (personal communication). Later (1907) he recommended its use for purposes of orientation of certain diseases of the lungs stating that a radiogram may be taken after blowing bismuth oxide through a dry extra drainage tube (1). He subsequently reported the use of this method of lung mapping (2) in a large number of cases for the radiographic localization of foreign bodies and of bronchiectatic and abscess cavities without any harmful effects to the patients.

Coincident with this work it was observed in the use of radiopaque mixtures in the roentgen ray diagnosis of oesophageal disease that accidental aspiration of these substances into the air passages occurred not infrequently.

Beeler (3) reported a case of accidental aspiration of a barium mixture.

Stewart (4) discovered a case of oesophago-tracheal fistula in which a quantity of bismuth mixture was aspirated directly into the trachea. He later found three additional cases. Accidental aspiration while swallowing bismuth or barium solution has since been repeatedly observed occurring more often in

patients with cancer of the upper oesophagus especially when associated with paralysis of the recurrent laryngeal nerves. These accidents are usually unattended with any systemic reaction.

*Radiopaque substances used.* In order to carry out pneumonography successfully as an aid to the roentgenologist it is necessary to use an agent which is opaque to the roentgen ray, is capable of being introduced into the air passages and when so introduced will prove harmless to the patient. Many substances have been tried with various results. The subnitrate and subcarbonate of bismuth are the most commonly used powders and are considered as being harmless however under the influence of certain bacteria the subnitrate is capable of giving off nitrites and nitric acid thereby rendering it not absolutely free from danger. The writer experimented with barium sulphate insufflated into the air passages of dogs with a view of comparing its efficacy with the bismuth salts.<sup>2</sup> It was found to possess no advantages over the latter in fact it formed lumps more readily thus interfering seriously with its insufflation. Since its atomic weight is less than bismuth it is less opaque to the roentgen ray and so is less desirable than bismuth.

In addition to its use as a powder bismuth has been used in liquid form. The late H. L. Lynch (4) collaborating with W. H. Stewart used bismuth in aqueous and oily solutions injecting the mixture directly into abscess cavities. Not only did the methods furnish excellent data for purposes of localization but it also exerted a highly satisfactory therapeutic effect. The bismuth was used in pure olive oil in proportion of 1 to 2 and was boiled before using. After injection the emulsion would remain in the cavity from several weeks to as long as 2 months.

*Lipiodol* a vegetable oil containing 40 per cent by weight of iodine first used by

<sup>1</sup>Through the courtesy of Dr. J. E. See, professor of Surgery, Graduate School of Medicine, University of Pennsylvania, in whose laboratory the work was conducted.

<sup>2</sup>Read before the American Laryngological Rhinological

and Otology Society, Atlantic City, May 3.

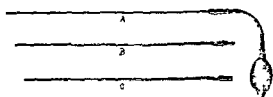


Fig 1 The Clerf bronchopneumograph consists of three tubes A, B, and C. A consists of a hollow tube, B is a cylinder fitted with a removable cap, and C is a cylinder fitted with a cap. The powder is placed in the tube C. To fill the powder loosely settled through the tube C into the tube B. It is then inserted into the trachea and rotated to disperse the powder in the loose space.

Siard for the localization of spinal cord tumors has been extensively employed by Sergent and Cottenot (5) Atmand DeLille and Moncreff (6) and others for the diagnosis of bronchial and pulmonary affections. The method employed by them consists of the injection of a quantity of the oily solution with a syringe through a small tracheal cannula which had previously been inserted

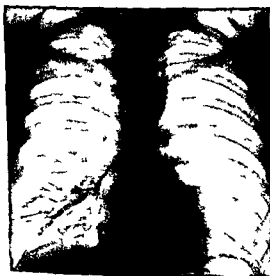


Fig 3 Roentgenogram of a man 30 years of age with an indolent history of sprains. A small but distinct shadow was seen in the right lower lung field which suggested a foreign body but did not correspond accurately to the usual position of the right bronchus. After the bronchoscopic sufflation of bismuth subcarbonate Dr. Cohen reported that the suspected shadow was of a type in the parenchymal tissues and was undoubtedly calcareous deposit.



Fig 2 Pneumogram made by Dr. John T. Farrell. Patient was married 6 years who had penetrating foreign body in the left lower lobe. The adhesibility of bronchoscopic removal of the bronchial wall was practiced by Charles Jackson was decided against and the surgery was delayed after localization of the fragment. The fragment was removed from the adjacent bronchus of the lower lobe bronchus. Dr. W. F. Mages reported that the large fragment because of its size could not be brought up through the bronchus.



Fig 4 Roentgenogram made in the case of a man aged 33 years who had a large abscess in the right lower lobe. Film taken by Dr. John T. Farrell after the bronchoscopic intubation of the calcareous deposit into the bronchial branch. The abscess cavity. Dr. W. F. Mages reported that the abscess cavity was well filled with a small quantity of the opaque material was present in the terminal branches of the right lower lobe.



Fig 5 Extensive bronchectasis in right lower lobe. Case (a) and (b) are pneumonograms made by Dr John T. Farrell after the bronchoscopy. Stillation of cul centimeters of lipiodol. Dr W. F. McGee reported that there was marked dilatation of the entire right lower lobe and that all of the bronchi could be traced to the terminal branches. The teroposterior view showed the uniform dilatation of the bronchi down to the level of the diaphragm. The lateral view demonstrated the marked dilatation in the size of the lower lobe.

into the trachea through the cricothyroid membrane under local anesthesia. By turning the patient to one or the other side the

oil can be made to run into the corresponding bronchus desired. As soon as the injection is completed the cannula is withdrawn and radiograms are immediately taken. The oil casts a heavy shadow on the ray plate consequently abscess cavities, bronchial dilatations and other pathology are clearly outlined.

In addition to using lipiodol the author has tried various other solutions notably aqueous solutions of sodium bromide and sodium iodide. Although successful in a few cases it was found that aqueous solutions are not well tolerated by the tracheobronchial mucosa. The iodine and bromide of sodium did not produce any deleterious local or systemic reaction however they were sufficiently irritating to excite the cough reflex so that but an occasional patient was able to retain the solution a sufficiently long time to permit of the necessary roentgenographic studies. Lynah tried thorium with apparently unsatisfactory results.

The methods of choice are the insufflation of dry bismuth subcarbonate or the injection of lipiodol and these are now used exclusively at the Bronchoscopic Clinic.



Fig 6 Pneumograms made by Dr Leo Sol. Case (a) and (b) are pneumonograms of the left lower lobe. Stillation of cul centimeters of lipiodol. Dr J. M. Luk reported that the posterior view showed the bronchi could be traced to the terminal branches. The teroposterior view showed the uniform dilatation of the bronchi down to the level of the diaphragm. The lateral view demonstrated the marked dilatation in the size of the lower lobe.



Fig 7 Anteroposterior and lateral pneumonograms of a patient aged 35 years who was referred to the Bronchoscopic Clinic by Dr Edward W. Simpson of the St. Louis Hospital. There was a history of an old right-sided empyema which had been drained externally. The findings on drainage were suggestive of fistulous communication between a bronchus and the old empyema cavity. Bismuth subcarbonate was insufflated to determine whether the present pathological process was confined to the pleural cavity or if the empyema bronchopleural fistula. Dr W. F. MacCles reported that the pathology of the empyema was almost entirely in the pleura and he was unable to demonstrate any evidence of a fistula.

#### TECHNIQUE

Bismuth subcarbonate should be dry and free from lumps. In addition it should be sterile. The application of dry heat tends to break up some of the subcarbonate into a carbonate and also increases its tendency to form small lumps. The insufflation is best carried out bronchoscopically using the author's bronchoscopic insufflator (Fig 1). With the Jackson bronchoscope inserted through the mouth into the bronchus or opposite the orifice of the bronchus to be mapped out the filled insufflator is introduced through the bronchoscope and its contents blown out with the aid of a hand bulb during deep inspiration. This method permits of the mapping of a limited portion of the lung. A specially devised powder blower to be used with the positive pressure apparatus was tried but did not prove satisfactory because of the physical characteristics of the powder and its too widespread distribution.

Lipiodol can be very readily injected through a Jackson aspirating tube which is introduced through a previously inserted bronchoscope and passed into the bronchus to be outlined. At the Bronchoscopic Clinic

this method of bronchoscopic instillation is used in preference to the injection through an intratracheal cannula since it permits of a more definite localization of the liquid to the areas to be outlined and can be carried out as a part of the diagnostic bronchoscopy.

As soon as the material has been introduced stereograms should be made in the anteroposterior position and an exposure made in the lateral with the side of the chest to be examined toward the ray film.

The quantity to be used depends very largely upon the results desired. In an adult as much as one ounce of bismuth can be used with safety since a great part of the material is expectorated. Ordinarily 3 to 4 drams will suffice. In a normal person practically all of the powder disappears within 24 hours as a result of cough and ciliary action rarely is there any remaining after 48 hours. The quantity of lipiodol used depends upon the age of the patient and the size of the cavities or bronchi to be mapped out and varies from 10 cubic centimeters in a patient about 10 years of age to 10 or 15 cubic centimeters in an adult. Sergeant and Cottenot (5) report the use of as much as 40 cubic centimeters in



Fig 8 Roe tgen gam mad by Dr W F M ge in the case f m age 3 year h g e a hist ry of hamoptysis Repeated physical mun t clinal ob rv tio and oe tg n r yst ds failed to el y den of p lmon rydisc se Ad gn tic b chose py perf med days fte a moderate pulm ry hamor rh gesh wed small quant ty f blood tinged sec tion in the lft m in br hus Pneum ography was done d bsmuth sube bonat sed cc dung t th Jackson method D W F Ma gs p rted the pes ce of p thology n the lower p rti of the pper lb nd th ppe porti n f the low r lb be wh h w s m re in th n t re f n niflt ti e p ocess a d mght b tuberc l s There w s rath r prompt narr wi g f the middle ds o f th uppe lb be bro chu (ind c t d by ar w)

an adult Several or more days are required to rid the cavities of the oil although cases have been reported in which small portions have remained for longer period (5)

#### UNTOWARD RESULTS

No harmful effects have been observed in a large series of cases in which pneumonography by bi smuth insufflation was done In no case has there been any retention of the bismuth with the formation of so called broncholiths The use of lipiodol is not entirely without danger Although there have been no ill results in the authors cases there has been reported one case (6) of acute iodism with cedema of the larynx Its use is inadvisable in persons susceptible to iodine

#### ANESTHESIA

As practiced in all endoscopic procedures at the Bronchoscopic Clinic a general anesthetic is never used A preliminary hypodermic injection of morphine sulphate may be given to both children and adults to obtund the cough reflex In addition a local anesthetic is used in adults This is never employed in children

#### INDICATIONS FOR PNEUMONOGRAPHY

As a diagnostic aid this method of localization presents so many possibilities that it is difficult to set forth definite indications for its use In a general way they may however be stated as follows

1 In foreign body work it has a distinct field of usefulness to localize a foreign body around the corner to establish the relation between a peripherally located foreign body and the nearest accessible bronchus to determine the relative position and size of the nearest bronchus in a case of penetrating foreign body (Fig 2) and to ascertain whether a suspected shadow is a foreign body in a bronchus or a calcareous deposit in the parenchymal tissue (Fig 3)

2 Lung abscesses are rarely seen bronchoscopically but can be definitely outlined and localized by mapping (Fig 4)

3 In bronchiectasis the degree and extent of the bronchial dilatation and the presence of terminal abscesses can be readily diagnosed by the introduction of a radioopaque substance and valuable data can be obtained for the surgeon (Fig 5) The presence and location of a bronchial stricture can be definitely ascertained as demonstrated in Luken's case (Fig 6)

4 Helpful data can often be supplied in a case of suspected bronchopleural fistula (Fig 7)

5 The extent of involvement of a primary malignant growth of the bronchus can often be accurately determined for the information of the surgeon as was so clearly shown in Chevalier Jackson's case (7)

6 In addition other infiltrating processes can often be demonstrated (Fig 8)

Although there is insufficient data available to warrant any definite statement re

garding the therapeutic value of the bronchoscopic insufflation of dry bismuth powder into a bronchus it has been successfully used as a haemostatic in a patient with adenocarcinoma of the bronchus who was almost completely exsanguinated from repeated pulmonary hemorrhages (7)

## CONCLUSION

1 In a large series of cases it has been conclusively demonstrated that the Jackson method of bronchoscopic insufflation of bismuth subcarbonate into the tracheobronchial tree is devoid of untoward effects. The introduction of lipiodol in selected cases seems harmless.

2 By increasing the visibility of the bronchial tree in cases of penetrating foreign bodies the roentgenologist can furnish information which will assist in determining the best method of removal.

3 In cases of lung suppuration a more accurate determination regarding the location and extent of the process is possible which will often be of great assistance in deciding the proper form of treatment.

4 Lung mapping combined with a diagnostic bronchoscopy will often lead to an early diagnosis in neoplasm of the lung.

5 Pneumonography used in conjunction with roentgenology affords the best available diagnostic aid to the thoracic surgeon.

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## AN ANALYSIS OF WOUND UNION

IN 3 000 ABDOMINAL INCISIONS BASED ON THE WOMAN'S HOSPITAL CLASSIFICATION OF WOUNDS AND WOUND UNION

BY BYRON H. COFF, M.D., F.A.C.S., NEW YORK  
J. A. I. 26 Gen. W. m. Hosp. 1

THE abdominal incision though a very simple operation has been ranked among the most important procedures in abdominal surgery by Sir Berkley Moynihan who has said "I do not think that though much has thereon been written it is yet adequately recognized that the steps in the making and in the repair of an abdominal wound are of the very greatest importance. I doubt whether it is any exaggeration to say that the circumstances connected with the incision are among the most important in the whole range of abdominal surgery. For if the incision be improperly made by the free division of muscular fibers or the willful and unnecessary severing of nerve trunks a weakened area is left in the belly wall the result of which may be of even greater severity than those conditions which first made the operation advisable. Too great care cannot therefore be exercised in the proper choice of a method of incision and of the means of its securest closure. This authoritative opinion has encouraged the writer to submit for consideration the facts which have been established by an analysis of the wound records in 3 000 cases operated upon by the members of the attending and junior attending staffs of the Woman's Hospital."

In discussing the subject of wound union in the abdominal incision from a technical viewpoint it is important to keep clearly in mind that the methods now employed in this procedure have been practically standardized and furthermore that the vast majority of surgeons are satisfied with the results which follow the employment of such methods. It is equally important however not to be forgetful of the fact that some form of faulty wound union occurs in a very considerable percentage of clean as well as in contaminated wounds made and closed by standard method and where rigid standards are applied con-

stitutes the most frequent and at the same time one of the most troublesome and time-consuming postoperative complications in abdominal surgery. The exact incidence of this complication has not been definitely determined because of a lack of standard classifications and adequate studies of sufficiently large series of cases.

The objects of the present study have been

- 1 To establish a classification of abdominal incisions dependent upon the conditions present at the time of operation
- 2 To establish a logical classification of wound union in such incisions
- 3 To learn the actual incidence of faulty union in both clean and contaminated incisions
- 4 To determine the maximum allowable incidence of faulty union in abdominal incisions
- 5 To compare the immediate results following the different methods employed especially in the closure of the wound

Conditions at the Woman's Hospital have been remarkably favorable for such a study because of the fact that all members of the staff operate upon very similar classes of cases under practically identical conditions. In each case studied the preoperative preparation, the protection of the wound at the time of operation, the materials used in the closure of the wound and the postoperative care of the case have been the same. Furthermore there has been in operation for the past four and a half years a definite method of recording wound union in all forms of incised wounds. It is to be noted however that despite the similarity of conditions under which the members of the staff work, no effort has been made to compare the results of one surgeon with those of another because of the differences in operative skill, the amount of trauma inflicted upon the tissues and other

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Fig. 1. Working record sheet of Wm. Hospital of New York.

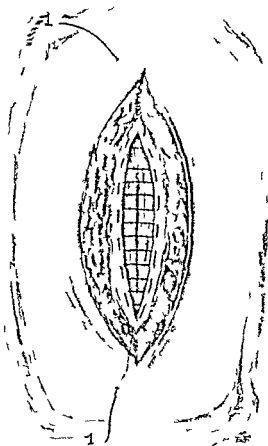
variations in technique all of which factor obviously make such a comparison impossible. The only comparison which can be safely made is one in which the results of each individual surgeon working with but a single variable factor—the character of uterine material—in two different groups of case are compared.

#### METHOD OF RECORDING WOUND UNION

Early in 1919 Dr George Gray Ward became interested in the subject of faulty wound union because of the morbidity and the costly

loss of time to the convalescent patient to the hospital and to the prospective ward patient for which it is responsible and instituted as a part of the hospital standardization program at the Woman's Hospital a method of recording the facts pertaining to the making of the closure and the union of all incised wounds of the abdominal wall, the mammary and lumbar regions and the vagina. A wound record form (Fig 1) was made a part of every case record so that all data concerning the wound might be recorded on one form in the record and a simple yet





The author has established an efficient card index system was established by means of which all facts concerning wound union may be tabulated. Only through the aid of this system has it been possible for the writer to review a rather large amount of statistical material.

#### CLASSIFICATION OF ABDOMINAL INCISIONS

Before a study of wound union in abdominal incisions could be made it was essential that the wound be classified according to the conditions present at the time of operation. All abdominal incisions included in this review have therefore been divided into two classes as follows:

**Class 1** Wounds clean at the time of operation.

In Class 1 are placed wounds which have not been exposed to infectious or septic material during operation.

**Class 2** Wounds contaminated at the time of operation.

In Class 2 are placed wounds which have been exposed to purulent material or material from sloughing or gangrenous masses of any sort to the contents of the urinary organ and to the contents of the gastrointestinal tract excepting cases in which operations on the interval appendix or gall bladder have been performed without drainage. Wounds through which operations have been performed for acute inflammatory disease are considered contaminated as are all wounds through which intra-abdominal or pelvic drainage has been established. On the contrary, wounds through which deliberate or accidental entrance into the vagina has been made are classified as clean wounds.

#### CLASSIFICATION OF WOUND UNION

The following classification of wound union which takes into consideration not only infection as a cause of faulty wound union but all other causes as well has been developed and adopted as the standard classification for the Woman's Hospital.

**Class A** Wounds which unite by primary union.

Any break in the union of a wound excludes it from Class A.

Any discharge of blood, serum or fatty material which occurs after the tenth day excludes a wound from Class A.

**Class B** Wounds which do not unite by Primary Union because of minor defects such as: (1) slight infection, (2) slight degree of fat necrosis, (3) small hematoma, (4) slight stitch hole infection which involves the line of union of the wound, (5) collection of serum discharged after the tenth day, (6) slight separation of the tissues, (7) slight degree of pressure necrosis, (8) cigarette or tube drain following the removal of which the wound healed promptly by granulation without infection, (9) cigarette or tube drain plus slight infection about the drainage tract, and (10) foreign

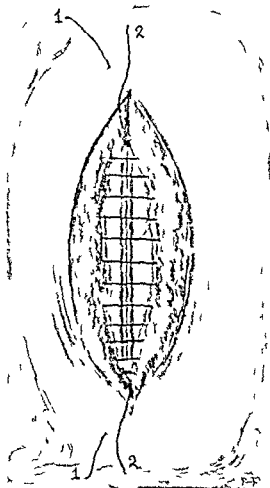


Fig. 3. The wound is a deep laceration of the upper lip. The suture of silk placed in the deep layer of the upper lip of the bottom lip.

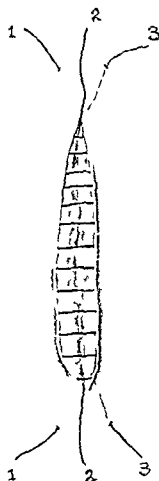


Fig. 4. The wound is a deep laceration of the upper lip. The suture of silk placed in the deep layer of the upper lip of the bottom lip. The suture is tied to the skin on both ends of the wound. The suture is cut 3 inches from the angle of the wound and not tied.

body (unabsorbed suture material etc) following the removal of which the wound heals promptly by granulation with or without slight infection.

No case which has been detained in the hospital one or more days because of the condition of the wound is to be placed in Class B.

Class C. Wounds which do not unite by Primary Union because of major defects such as (1) extensive infection (2) marked degree of fat necrosis (3) large hematoma (4) extensive stitch hole infection which involves the line of union of the wound (5) wide separation of the tissues with or without

partial evisceration which results in prolonged healing by granulation with or without infection (6) marked degree of pressure necrosis (7) cigarette or tube drain following the removal of which the drainage tract heals by prolonged granulation without infection (8) cigarette or tube drain plus extensive infection about the drainage tract (9) foreign body (unabsorbed suture material etc) causing a sinus along which there is prolonged granulation or infection and (10) intestino abdominal or vesico abdominal fistula.

All cases which have been detained in the hospital one or more days because of the

condition of the wound are to be placed in Class C

Small rubber tissue or silk worm gut drains placed in the fat of the abdominal wall are not to be considered causes of faulty union

#### MATERIAL STUDIED

The present analysis covers 3000 abdominal incisions made and closed by 9 members of the attending and junior attending staffs of the Woman's Hospital over a period of approximately three and a half years. Of the 3000 incisions 2755 have been classified as clean while 245 incisions have been classified as contaminated at the time of operation. The procedures performed through these incisions have been largely gynecological with an occasional operation on the appendix or gall bladder or for some type of hernia. Mammary and kidney incisions have been excluded. The vast majority of incisions have been longitudinal median ones the remainder have been transverse suprapubic paramedian McBurney or inguinal. With the exception of a very small number the incisions have been of the intermuscular type rather than the type in which muscle fibers are separated.

#### PRE OPERATIVE PREPARATION OF ABDOMEN AND PROTECTION OF WOUND AT THE TIME OF OPERATION

Approximately 12 hours before operation the abdominal skin from ensiform to pubes is washed with tincture of green soap and water which are applied with gauze. Following the removal of the soap by means of sterile water the skin is washed with alcohol followed by ether which is allowed to evaporate before a dressing of sterile gauze is applied. Not less than 1 hour and not more than 4 hours before operation the skin is painted with 3½ per cent tincture of iodine and covered with fresh sterile gauze. A second application of 3½ per cent tincture of iodine is made on the abdominal skin a few moments before the abdomen is opened.

During the operative procedure all of the incised tissues from peritoneum to skin are protected by means of folded towels or gauze pads which are held in place by suitable

clamps. The protection is not removed until the operator is prepared to close the incision.

#### METHODS OF CLOSURE OF INCISIONS

Two widely different methods of wound closure have been employed. In one the abdominal wall has been closed in layers by catgut sutures of the best quality supplied by a prominent manufacturer reinforced by removable tension sutures of silk or silk worm gut. In the other the closure has been accomplished by means of removable silk sutures in all layers excepting the peritoneum. The former method is one with which all surgeons are familiar while the latter method is unique and therefore requires a somewhat detailed description.

#### CLOSURE OF THE ABDOMINAL INCISION BY REMOVABLE SUTURES OF SILK

A number of years ago Dr. C. G. Child of New York conceived the idea that catgut which must be converted into a soluble gelatin before absorption by the body tissues, possibly constituted an important predisposing cause of infection in the incised abdominal wound. He reasoned that this gelatinous material in the presence of body temperature, body tissues and fluids formed a favorable culture medium for the growth of pyogenic micro organisms which might be introduced at the time of operation and that the absorption of catgut placed an unnecessary burden upon the tissues of the belly wall especially on the areolar fat filled and relatively avascular layer which lies between the anterior sheath of the rectus muscle and the skin. He furthermore argued that catgut because of its unreliability in sterility and tensile strength and the wide variations in the time necessary for its absorption in different individuals was not a dependable suture material to employ in a structure such as the sheath of the rectus muscle upon which the future integrity of the belly wall largely depends. Child therefore abandoned all absorbable suture material in the closure of the abdominal incision in all layers excepting the peritoneum and attempted to close the wound by means of a continuous mattress

suture of silkworm gut which was to have been removed on the twelfth or fourteenth postoperative day. This method proved a failure because of the difficulty of removing without breaking the suture. Silver wire in the form of a continuous mattress suture was next tried and though not practical because of considerable difficulty in placement and removal was responsible for very excellent results. The incidence of infection in wounds closed by this method was decidedly lower than in gut closed wounds. In 1915 there was placed upon the market by a prominent manufacturer of suture material a specially treated twisted silk tension suture of great tensile strength and pliability. This material was substituted for silver wire in the closure of incisions and has given practically ideal results. This last method has been used in the closure of 110 clean and 87 contaminated incisions in the series under consideration. In detail the method is as follows:

*Placing the sutures.* The peritoneum transversalis fascia and posterior sheath of the rectus muscle are closed by a continuous suture of plain catgut.

The rectus muscle is not sutured.

The anterior sheath of the rectus muscle is closed by a continuous mattress suture of the prepared silk, both ends of which are carried through the fatty layer and skin to the surface on one side of the incision at the angles of the wound (suture 1 Fig. 3).

The deep layer of the superficial fascia of the abdominal wall is closed by a continuous mattress suture of prepared silk, the ends of which are passed through the fatty tissue and emerge at the angles of the wound (suture 2 Fig. 3).

The skin is closed by a subcuticular continuous suture of prepared silk, the ends of which are passed through the skin to the surface on the side of the wound opposite that upon which the deepest suture emerged (suture 3 Fig. 4).

When the sutures are being tightened it is important not to pull them backward and forward after they have been placed but to allow them to remain stationary as there is a certain cohesion between tissues and suture material which assures an ideal approximation until union is complete.

Suture No. 1 is tied by a bow knot to suture No. 3 over a gauze bolster at the lower angle of the wound. The other ends of the same sutures are tied together in a similar manner at the upper angle of the incision. The ends of suture No. 2 should be at least 3 inches each in length and should not be tied.

*Removal of sutures.* On the tenth postoperative day the bow knot at the lower angle of the incision is untied and the bolster removed. A small amount of tincture of iodine is allowed to run into the suture tracts the sutures are iodized near the skin and then cut beneath the surface of the skin. At this time the upper ends of the sutures are not disturbed. No attempt to remove any of them at this time is made. On the twelfth day the upper bow knot is untied and a gentle attempt made to withdraw all three sutures—the skin suture (suture No. 3) first, the suture in the deep layer of the superficial fascia (suture No. 2) next, and finally the suture in the anterior sheath of the rectus muscle (suture No. 1).

If the removal of any of the sutures is found to be difficult a small artery clamp is placed on the end of the suture to prevent retraction beneath the skin and wrapped in the dressing until a second attempt is made the following day. The second or third attempt results in easy removal if the sutures have been properly placed at the time of closure.

The advantages of this method of wound closure over the usual catgut method are:

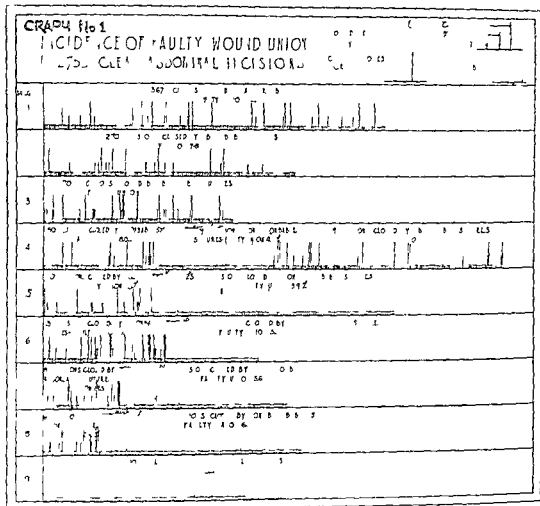
1. A dependable suture material of great tensile strength is employed. The tensile strength of catgut is always questionable after the 10th postoperative day it is negligible.

2. The suture material is thoroughly sterilizable without a reduction in its tensile strength. The sterility of catgut is always questionable.

3. The tissues especially the fatty tissues are not required to absorb a foreign body such as catgut.

4. Apposition is ideal without strangulation of the tissues until union is complete.

There is but a single objection to the method and that not a serious one, namely removal is difficult if the suture has not been properly placed or if a premature attempt at



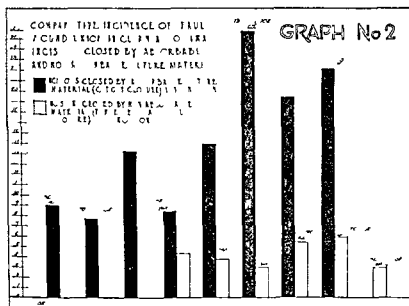
removal is made. If perchance a part of a suture should be left permanently in the tissues through breakage at the time of removal, no harm has been done. In this connection it is important to bear in mind the fact that surgeons of wide experience bury silk sutures in the sheath of the rectus with no intention of removing them. In no case in the series studied has it been necessary to reopen the wound for the removal of a suture broken in removal.

Of 2755 incisions classified as clean, 1645 have been closed by the conventional catgut method while 1110 have been closed by the removable silk suture method described above.

Of 245 incisions classified as contaminated at the time of operation, 158 were closed by catgut and 87 closed by removable silk sutures. The results are shown in the following graphs.

#### ANALYSIS OF GRAPHS

Graph 1 shows the chronological incidence of faulty wound union in 2755 clean abdominal incisions. It brings out the fact that Surgeon 1 has closed 367 incisions by the conventional catgut method with a faulty union of 9 per cent. Surgeon 2, who has used a similar method in 270 cases, has met with an incidence of faulty union of 8 per cent while in the work of Surgeon 3, who has also used a



catgut closure in 220 incisions there has been an incidence of faulty union of 14.3 per cent. The part of the graph which deals with the work of the next 5 surgeons Surgeons 4, 5, 6, 7 and 8 is of special interest in that it shows a decided reduction in the incidence of faulty union upon the abandonment of catgut and the adoption of the removable silk suture method of closure. In the case of Surgeon 4 there has been a reduction of faulty union of approximately 100 per cent while it has been greater in the work of Surgeons 5, 6, 7 and 8. It will be noted that the conversion from one type of closure to the other has occurred at a different time in each instance. Surgeon 9 who has employed only the removable silk suture method of closure in 261 incisions has met with an incidence of faulty union of 3.0 per cent. This graph brings out very clearly one very important point namely that with all other factors remaining constant the adoption of the removable silk method of closure has in the work of all surgeons who have used both methods invariably resulted in a very decided reduction in the incidence of faulty union in the abdominal wound.

Graph 2 shows clearly the relative incidence of faulty union in clean incisions closed by absorbable and non absorbable suture material. Special attention is called to the fact

that the incidence of faulty union in incisions closed by the removable silk suture method has been in every instance lower than the lowest incidence in catgut closures.

Graph 3 shows the relative incidence of the causes of faulty union in 2,755 clean abdominal incisions. In practically every instance the incidence of defective union has been lower in the wounds closed by non absorbable suture material. The one exception is found under the heading Wide Separation of Tissues in which case the figures are based on three accidents of this sort in the work of Surgeon 4 and one in the work of Surgeon 9. The graph shows clearly that the total average incidence of faulty union in clean abdominal incisions from all causes has been 4.3 per cent in wounds closed by non absorbable suture material while in wounds closed by absorbable sutures the total average incidence of faulty union has been 12.1 per cent.

Graph 4 shows the chronological incidence of faulty wound union in 45 contaminated abdominal incisions. Attention is called to the fact that the number of contaminated cases operated upon by each surgeon is small excepting in the case of Surgeon 4. The graph therefore is of somewhat less value than if there had been larger numbers of cases from



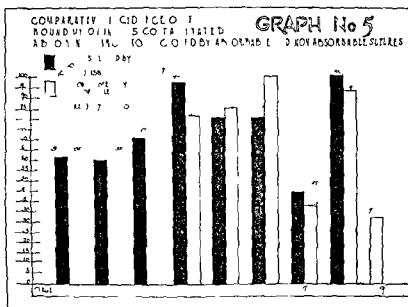


TABLE A—INCIDENCE OF INFECTION IN 755 CLEAN ABDOMINAL INCISIONS

	Infection (CLASS C) Per cent	Slight infection (CLASS B) Per cent
645 incisions closed by absorbable sutures (catgut closure)	47	53
11 incisions closed by non absorbable sutures (emil silk suture closure)		9

TABLE B—INCIDENCE OF INFECTION IN 4 CONTAMINATED ABDOMINAL INCISIONS

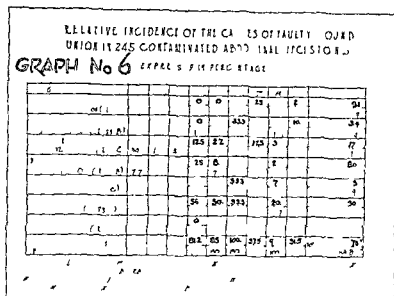
	Infection (CLASS C) Per cent	Slight infection (CLASS B) Per cent	Drainage (CLASS C) Per cent	Drainage (CLASS B) Per cent
38 incisions closed by absorbable sutures (catgut closure)	89	44	90	81
37 incisions closed by non absorbable sutures (emil silk suture closure)	9	34	72	90

cisions from all causes including drainage has been 70 per cent in wounds closed by non absorbable suture material against 83.5 per cent in wounds closed by catgut

A perusal of Graphs 3 and 6 shows that though there are other important causes of faulty wound union *infection is the principal cause*. Since this is true and since surgeons who consider infection only when thinking of faulty wound union may care to compare their results with those of the Staff of the Woman's Hospital tables which show the incidence of infection only have been prepared (Tables A and B)

A final examination of the six graphs reveals facts which substantiate Child's theory that absorbable suture material such as catgut used in the closure of the abdominal incision constitutes the important and avoidable predisposing cause of infection in the tissues about the incision especially in the more or less avascular fatty layer which possesses lower powers of resistance to infection than the fascia and skin which lie on either side of it. Furthermore the figures show that in the hands of the same surgeon with all factors excepting the character of suture material remaining constant the conventional catgut closure which has been so generally adopted as the method of choice





gives results inferior to those which follow the closure of the wound by removable non absorbable suture material such as silk.

The site of the abdominal incision is believed by some to be a factor in wound infection. Some surgeons are firmly of the opinion that the longitudinal median type of incision is less likely to become infected than the transverse suprapubic type while others believe the contrary. In this study it has been found impossible to make a definite statement on this point because of the fact that no one surgeon has used both types of incision a sufficient number of times to warrant a conclusion. It is interesting to note however that Surgeon 3 who has used the catgut closure only has met with an incidence of faulty union of 14.8 per cent in a series of 108 clean transverse suprapubic incisions and of 1.6 per cent in a series of 95 clean longitudinal incisions while Surgeon 9 who has employed the removable silk suture method of closure only has met with an incidence of faulty union of 2.4 per cent in a series of 165 clean transverse incisions and of 4.2 per cent in a series of 96 longitudinal incisions. It will be noted that the incidence of faulty union of 2.4 per cent in 165 clean transverse suprapubic incisions represents the lowest incidence of faulty union in the entire series

studied. It is obvious therefore that the incidence of faulty wound union can be kept as low if not lower in the transverse type of incision than in the longitudinal incision despite the belief that the transverse type of wound is the more likely to become infected.

From an economic viewpoint faulty union in the abdominal incision is a costly and time consuming complication to both patient and hospital. In the series of 3000 cases under consideration there has been a total loss of 3086 hospital days due to defective wound union. In the series of 2755 incisions clean at the time of operation 245 failed to unite by primary union with a loss of 1587 hospital days while in the series of 245 contaminated incisions 193 failed to unite by primary union with a loss of 1499 hospital days. It is difficult to calculate with any degree of exactness the loss of hospital days which might be considered justifiable in this or any other series of cases. It is obvious however that no other postoperative complication with which the abdominal surgeon meets is responsible for a loss of time comparable to that caused by faulty union of the abdominal incision made and closed by conventional methods.

It is to be regretted that time has not permitted a study of end results in the entire

series of cases especially in regard to the incidence of postoperative hernia. That study will be made in the future.

A review of the material studied leads to the following conclusions:

1 If correct standards are rigidly applied in the recording of wound union, faulty union in abdominal incisions made and closed by standard methods constitutes the commonest postoperative complication in abdominal surgery.

2 The most important predisposing causes of faulty wound union in the order of importance are absorbable suture material (catgut), trauma and poor technique.

3 The principal exciting cause of faulty wound union is infection.

4 In the series of cases studied the average incidence of faulty wound union from all causes in clean abdominal incisions closed by absorbable suture material has been 72.1 per cent while in clean incisions closed by non absorbable suture material it has been 43 per cent.

5 The average incidence of infection in clean abdominal incisions closed by absorbable suture material has been 10 per cent while in clean incisions closed by non absorbable suture material it has been 40 per cent.

6 The average incidence of faulty wound union from all causes in contaminated abdominal incisions closed by absorbable suture material has been 83.5 per cent while in contaminated incisions closed by non absorbable suture material it has been 70.0 per cent.

7 The average incidence of infection in contaminated abdominal incisions closed by absorbable suture material has been 41.1 per cent while in contaminated incisions closed by non absorbable suture material it has been 37.7 per cent.

8 With the methods available at the present time the incidence of faulty wound union from all causes should not exceed 5 per cent in clean incisions and 70 per cent (including drainage as a cause of faulty wound union) in contaminated incisions.

9 A comprehensive classification of wound union will take into consideration not only infection as a cause of faulty wound union but all other causes as well.

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## DOES BONE FORM FROM OSTEOBLASTS OR FROM A METAPLASIA OF THE SURROUNDING CONNECTIVE TISSUE?

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**O**PINIONS vary as to the rôle played by the different tissues of bone in its regeneration. One investigator may regard the periosteum, another the endosteum, and another the cells of the bone itself as the important factor in the union of fractures in the correction of defects, and in the obtaining of satisfactory results in transplanting bone. It should be mentioned that there are investigators who regard the periosteum, endosteum or bony cells themselves as capable of producing bone and that the other tissues of the bone have no function whatsoever. However, there are some men who believe that the formation of bone after trauma, etc., and in transplants is dependent largely and some times entirely on a metaplasia of the surrounding connective tissue.

In our study we have endeavored to determine two points:

1. What rôle the different elements of bone play in bone regeneration.
2. What the possibilities are for bone regeneration from metaplasia of the connective tissue.

## 1. THE RÔLE OF THE DIFFERENT BONE ELEMENTS IN BONE REGENERATION

In contradistinction to the physiological regeneration there is with the regeneration which starts as a result of tissue stimulation an accidental or pathological regeneration which is the change in the tissue caused by external damage of some kind (infection or injury). The difference between the two forms of regeneration is basic and depends upon these factors. In physiological regeneration the used and lost tissue substance is constantly replaced in a typical way; in the pathological regeneration a complete anatomical replacement is never attained even if an attempt is made to replace functionally the lost or damaged tissue. The most complete regeneration is found in the replacement of

injured parts of the connective tissue of blood vessels. The specific organ or tissue to which bone belongs as a whole is of such a nature as to make the normal regeneration of bone impossible.

These basic principles which are true for all pathological regeneration also apply in all healing processes which are the result of injury or trauma to bone. At best the end result may show a very nearly normal bone in form and structure (complete regeneration) or it may show a bone which is more or less abnormal in form (incomplete regeneration) but which gives good function. The amount of regeneration attained depends directly upon the extent to which the blood vessel connective tissue apparatus of the organ or tissue is disturbed through the damaging influence of the processes following injury or infection so that it is important to remember how essential it is to preserve the blood supply and to avoid changes in the blood vessel apparatus of the bone in question which might result from a manipulation to obtain a complete anatomical and functional result.

Lexer has repeatedly emphasized the great importance of this knowledge. According to Lexer as a result of injury the blood vessel system of the bone involved reacts by filling the blood vessels and new blood vessels are formed. These processes follow one another with the constancy of a law of nature. As a result of hyperæmia all the functions of the involved bone are increased and with this the regeneration changes begin. Through the hyperæmia the organism prepares for regeneration; the tissues at the site of and surrounding the injury securing nutrition to the part and the replacement of material and removal of waste products. In addition through the disturbance of the processes inaugurated by the hyperæmia the hyperæmia is further maintained through the products of destruction and the blood. The causes of regeneration in

chronological order are trauma hyperæmia and products of tissue destruction. Their results are hyperplasia, proliferation and hypertrophy of the specific and non specific tissue elements which under normal conditions develop into fibrous scar tissue or a pseudoarthrosis.

To determine the role the different bone tissues play in bone regeneration a series of experiments were performed with each tissue of the bone that is periosteum, endosteum and the compact bone. Always just the one tissue was tested, the other two were destroyed. At the same time in each series the blood supply to the tissue to be tested was kept intact while that going to the other two tissues was damaged. The influence of the age and function was also considered.

With reference to the series of experiments to test the ability of the periosteum to regenerate a few fundamental facts must be noted. The periosteum is built up of two layers: the outer layer, the adventitia, is made up of connective tissue rich in blood vessels and serves as a connection between the surrounding tissue, provides for the most part the nourishment of the bone and serves as a delimiting membrane; the inner layer, the fibro-elastica or cambium layer, is poor in blood vessels, consists of elastic fibers running in the long direction of the bone and round spindle shaped connective tissue cells, also connective tissue fibers and presents on the side toward the bone a layer of cortical cells with round dark colored nuclei (osteoblasts). The periosteum is bound to the bone by the interlacing of blood vessels in and out of the bone into the periosteum through bundles of connective tissue (Charpey's fibers) and by means of elastic fibers. This union is loose in growing and young adult animals but it is quite firm in full grown and especially in old animals. The fullness of the blood vessels in the bones decreases with age. As the real specific layer capable of regenerating bone is the cambium layer and as it receives its blood supply from the adventitia (the blood vessels coming through the compact bone from the marrow canal are of little importance) it is clear that for bone regeneration both layers and in proper relationship are necessary. It is clear

too that the adventitia should not be separated from the surrounding soft parts because from the soft parts the blood vessels penetrate into the adventitia. On the other hand it is not necessary for periosteal regeneration and bone production that there be union between the cambium layer and the compact bone. In doing the experiments and in estimating the results it is important to keep the cambium layer, adventitia and surrounding soft parts of the bone (fascia, muscles and connective tissue) in their natural relationship. This can be done only if at operation the compact bone (ulna or radius) is exposed by an incision made by a sharp knife and the work is done through this incision. The periosteal tube together with its surrounding tissues is separated by sharp dissection from the compact bone (Lever).

At operation we worked from the radial side of the forearm toward the radius or in other cases from the ulnar side toward the ulna, taking the greatest care not to disturb the soft parts. After separating the periosteal tube together with the soft parts for 1.5 to 2 centimeters the compact bone and marrow were removed by sawing the freed bone through at both ends, curetting the marrow canal of the bone remaining at each end with a sharp curette or plugging each end (in order to exclude the myelogeno-endosteal bone regeneration). Following this the periosteal tube with its nutrient vessels undisturbed and the soft parts were carefully sutured. In other experiments under the same conditions only one half of the periosteal tube was left and the other half removed. In these cases the ends of the bones were not united by means of a periosteal tube but by half a periosteal tube which was not sutured. The marrow canals were curetted and the soft parts sutured. In other experiments the radius or the ulna with its surrounding periosteum would be freed for about centimeters from its surrounding soft parts. From this piece of periosteum and bone completely freed from its surroundings a piece of bone 1.5 centimeters long including the marrow canal was sawed out subperiosteally and the marrow canals of the ends remaining filled with an autogenous piece of compact bone (without

periosteum and no endosteum). This periosteal tube which had been completely separated from its surrounding soft parts was sutured and the soft parts closed. In these experiments the bone ends were united by means of a periosteal tube which covered the bone ends but the tube had been separated from the soft parts and therefore was separated from its blood supply.

In our experiments on old animals we were never able to obtain bone regeneration from the periosteal tube. Lexer has pointed out that on account of the union between the cambium layer and the cortical layer in old animals the separation of the periosteum from the bone is difficult and under normal conditions is extremely unuseful. According to Lexer it is for this reason that bone regeneration is unuseful in the experiments of Axtell. Axtell believes that the periosteum of full grown animals cannot produce bone because it has exhausted the power to do so. By means of infection or trauma according to Axtell it can be stimulated again. In the cases the stimulus for growth comes from the necrotic part next the periosteum. He explains this factor for that in such cases there is a barrier between the living bone which influences the periosteum to regenerate bone. According to Lexer there is a growth stimulus which comes from the necrotic bone and works upon the osteoblasts. However the main cause for bone regeneration is to be sought in cases in which the periosteum and bone are united for between the periosteum and the compact bone where the cambium cells are retained bone regeneration takes place. From these facts it develops that under the usual experimental conditions *the periosteum of old animals does not form bone*. For the development of its bone building power the blood supply which comes from surrounding tissue must not be destroyed so that the hyperæmia from the fracture may reach the cambium layer. Following our line of reasoning—that by retaining the natural union between the periosteum and compact bone even in old animals where the retained cambium cells produce bone—we exposed the compact bone in old animals by means of an incision in the usual manner

loosened the periosteum a little from the compact bone and through this opening of the periosteum removed the cortex with a Layer's saw so that only a small part of its outermost layer was in contact and remained with the periosteum. The marrow canals were curetted as usual. Viewed from the inside one could see the periosteal tube with small pieces of cortex clinging to the periosteum which was united with the surrounding soft parts. At these places where the bone clings to the periosteum the cambium layer was retained. The periosteal tube and soft parts were sutured as usual.

In other cases in old animals we studied the periosteal regeneration process after the compact bone and endosteum had been removed. Following operation the periosteum was stimulated through trauma. Lexer has pointed out that in old animals such a traumatically stimulated periosteum with its layer of osteoblast and cambium cells is easily separated from the cortex. Following Lexer's experiments we produced subcutaneous fracture of both femur bones in old animals and put the limb at rest in a plaster-of-Paris splint. After 8 days the splint was removed and from the middle of the radius a cylinder of bone marrow and endosteum was resected in the usual way the cylinder containing the site of the fracture. We know as Lexer found in his experiments that in the region of the fracture the periosteal tube which just above and below was thickened by callous formation was easily separated in the region of this callous formation from the cortex. As a result of the extraordinary fracture hyperæmia in these experiments the bleeding was quite marked at operation the opposite of what had occurred in previous experiments. Also in this series of experiments the marrow canal at both ends was curetted and the periosteal tube and the surrounding soft parts sutured. A plaster-of-Paris splint was worn for 4 weeks.

At the same time certain preliminary remarks with reference to the series of experiments determining the bone building power of the endosteum must be made. A separate discussion of endosteum and marrow is not necessary as first both are in intimate contact so that it is impossible to separate them

without disturbing them and second the endosteum is nothing more than a very thinly developed fibrous membrane of the marrow which is attached to the compact bone and completes the lining of the marrow canal. The endosteum is furthermore built up of connective tissue blood vessels and cells. The endosteum consists of one layer of flat or cubical cells (osteoblasts) and fine connective tissue bundles. Connective tissue fibers traverse the whole marrow canal elastic fibers are absent. For our investigation the marrow cells are of no interest but the osteoblasts osteoclasts connective tissue and fat cells are of importance. In our experiments we could convince ourselves that in the diaphysis of young animals there was red myeloid marrow and in the diaphysis of old animals yellow fatty marrow. Quantitatively the osteoblastic tissue in the marrow endosteum was more abundant than that in the periosteum. The blood vessel supply of the marrow endosteum according to Lever's investigations in young animals comes from four sources: first through diaphyseal circulation of the nutrient artery second through blood vessels of the metaphysis third through blood vessels of the epiphysis fourth through anastomoses which come from the periosteal vessels and pierce the cortex. In young subjects there are especially at the period of greatest growth profuse anastomoses between the blood vessels and marked filling of the blood vessels. After this growth has completed itself this hyperæmia subsides so that the endosteum of the marrow is cared for only by the delicate nutrient artery and isolated anastomoses between metaphyseal and epiphyseal blood vessels.

It is of the greatest importance to injure the endosteum of the marrow as little as possible. At first we attempted by means of a small rongeur to remove the compact bone from the endosteum cylinder. It was impossible with this technique to prevent the tearing or crushing of the endosteum by the instrument or pressure from the splinters. For this reason we employed the following technique with its periosteal covering the bone in question (ulna or radius) was exposed. After this the surrounding soft parts in the region of the

defect were scraped with a sharp knife and spoon in order to remove with certainty the small pieces of remaining periosteum clinging to the soft parts. If the nutrient artery was to be retained the defect was placed distal to the nutrient canal and furthermore the place of entrance (in the radius and ulna in the middle of the diaphysis and on the ligamentum interosseum in the tibia in the upper third and behind) was protected because the periosteum remained in union with the bone and surrounding soft parts for some distance. If the nutrient artery was disturbed the vessel was torn at the place of entrance through the loosening of the periosteum. The upper and lower ends of the bone to be removed were sawed with a fine saw on the opposite and near side so that the innermost layer of bone was intact. This gave four places where the bone was sawed through almost to the endosteum (two above and two below lying opposite each other) between which the bone and its periosteum were to be removed. In case a larger defect is to be made the bone is sawed midway between the upper and lower saw lines on the inner and outer side. Now a flat chisel is used and inserted in the saw lines at different places tapping it gently each time so that the fragment of bone to be removed is not displaced but so that the inner layer of remaining bone is just cracked. In this way the bone with its periosteum can be easily removed without damaging the cylinder of endosteum in any way. There remain the two bone stumps united by the undisturbed cylinder of endosteum containing the marrow. The periosteum on the stumps is scraped off in order to prevent it from taking any part in the formation of bone. After this the soft parts and skin are carefully sutured.

It has been pointed out that on account of the defect the fragments are movable and as a result the keeping of the cylinder of endosteum intact is endangered. Certainly this danger is present but in a series of experiments the danger can be minimized by applying plaster of Paris splints and in another series the danger can be increased by treating the defect without splints. We emphasize especially that we have regarded only the cases worthy of consideration in which the



a plaster of Paris plint applied and worn for 4 weeks. The roentgenograms (Fig. 1) show the defect immediately after the operation and 12 and 82 days after operation. Twelve days after operation the two fragments are seen to be united by a continuous shadow which still shows lighter areas. The radial side of the ulna shows (above the operative area) a long narrow shadow which in the region of the operation is united with a similar long strip of the radius. In the roentgenogram taken 82 days after operation both bone stumps are united by means of a thick well formed callous mass which on the outer side of the radius still shows a concavity. The marrow cavity in this callous mass has not been formed. Radius and ulna are united by means of a bridge like shadow. In the microscopic preparation (Fig. 2) there is a periosteal callous mass with an outer layer of compact bone and an inner spongy layer containing newly built marrow spaces. This callous mass is united with the ulna so that the union is scarcely recognizable. The finer microscopic structure of this periosteal callous mass just as in the macroscopic is well formed and the static relationship is already well begun by means of the arrangement of the long lamellar system in the outer layer and by the outspread lamellar system unevenly distributed through the more spongy layer by resorption. In the outer layer the architectural structure of the newly built cortex is completed. In the inner layer the destruction of the superfluous bone areas is still in process. Through the activity of the osteoblasts and osteoclasts of the regenerating marrow the marrow canal of the central fragment in the preparation is pushed finger like into the periosteal callus in the peripheral fragment the canal is already open and united with the marrow spaces of the periosteal callus. Furthermore one can see in the preparation how periosteal callous masses have formed bridges between the radius and ulna. Those bridges are probably formed by mechanical stimulus

showed in all its parts (cambium layer and adventitia) fibrous degeneration.

Here we can also show a typical case. In a young rat we removed a circular piece of compact bone with the marrow canal and endosteum. We destroyed the nutrient artery and plugged the marrow canals of each fragment with autogenous compact bone. After the periosteum had been loosened on all sides from the soft parts. The ends of the bones in this experiment were united by means of a periosteal tube which was sutured continuously and freed on all sides from the soft parts. Roentgenogram 3 shows the defect immediately after the operation and 2 months later at which time we find that the atrophic stump ends without any callous formation. In the histological preparation (Fig. 4) one can recognize that bone formation has stopped wherever the outer side of the adventitia has been separated from the soft parts. From here toward the defect and in the defect itself there is only a fibrous connective tissue rich in cells, the fibrous elements of the fibroelastic layer and adventitia while the cambium layer itself is no longer demonstrable. At the ends of the stump and in the atrophic plugs there is present a very meager myelogeno-endosteal callous formation. In the formation of the connective tissue in the defect in addition to the fibrous degeneration of the periosteum there is the surrounding non specific fibrous tissue.

With these bone regenerative processes no stimulus due to hormones comes into play as regeneration is possible only because the cambium layer is united with its adventitia which carries the blood vessels and nourishment and thus makes it possible to secure a hyperemia which reaches the osteoblasts. With bones it is the same as with all other tissue and organs. Life function and regeneration are possible only so long as the circulation leading to the tissue in question is intact.

Beside the undisturbed union of adventitia and cambium layer there is necessary for the same reason union of the adventitia with the surrounding soft parts. We could show that a periosteal tube separated from its surrounding soft parts could build no bone but that it

While the bone building power of the periosteum of younger animals is generally acknowledged it is disputed by Bier and his school as in the case of the periosteum of older animals in so much as the periosteum is not stimulated from the marrow or cortical bone to regeneration by means of a hormone. Contrary to this we were able to confirm the views of Lexer and others that the bone building powers of the periosteum of older animals is not destroyed but that it begins in the same way when the conditions for the cambium layer remain the same as in the young animals. Its course is because of the slowing up of all regenerative processes somewhat slower. In older animals one of the experimental conditions we were not able to retain in the periosteal tubes was the necessary union between the cambium layers and the adventitia. In subperiosteal resection in old animals the cambium layer remained for the most part on the compact bone and so was removed when the bone was removed. As we have already explained in these cases there was no bone building just as has been reported by other



authors. In these experiments bone building took place only where the periosteum was not separated from the compact bone and it grew just as in the case of younger animals. In such experiments on old animals we made a histological investigation of the removed cortical bone and demonstrated that everywhere on its outer surface osteoblasts were present. At the same time small pieces were excised from the periosteum and only occasional cambium cells were demonstrated histologically.

These processes are shown in Figure 5. In an old male cat we resected subperiosteally from the right radius a cylinder of compact bone marrow and endosteum 1.5 centimeters long and sutured the periosteal tube and the soft parts. In Figure 5 we see the defect immediately after the operation and 39 days later. Here the stump is atrophic but there is no callus formation. Distalward from the incision on the peripheral fragment there is just opposite the ulna a small exostosis. Histologically there are periosteal callouses on the stump ends while in the defect there is a fibrous scar which closes the marrow canal.

It is to be expected that in old animals when it is technically impossible to keep the cambium layer in union with the adventitia, periosteal bone regeneration in the defect will not occur. In histological preparations of such cases there is found as explained periosteal bone building on the outer surfaces of the stumps. From this there would seem to be special relationships or conditions present. In such experiments one should remember that conditions are produced which correspond only in part or not at all with natural or normal conditions. The negative results in these cases are the opposite to those found in bone healing in older people in whom just as in young people there is a marked periosteal callus formation although the process is somewhat slower. An injury which produces a fracture never causes so marked a separation between the cambium layer and the adventitia as occurs in experiments in which a subperiosteal resection is performed in older animals. The natural union of both layers remains entirely or almost entirely intact in the largest number of cases.

If we compare these results with our experiments we find that even in old animals when the natural contact between the cambium

layer and adventitia is maintained periosteal bone regeneration takes place exactly as it does in young animals only the process is slower.

To illustrate the pictures of an experiment may be described. In this experiment a periosteal tube was made which had small splinters of the cortex hanging to it. Figure 6 shows the defect immediately after operation and 6 and 11 weeks later. The single splinters are seen in the defect. The periosteal tube united the two stumps as a bridge. The ulna broke while putting on the plaster-of-Paris bandage. Six weeks after operation the fracture of the ulna had united by means of a massive callus. The radial fragments which were separated about 0.5 centimeter were united only on the ulnar side by means of a united callous mass which at the central fragment is united with the callous mass of the ulna. On the outer side of the radial fragments there are massive deposits of callus which do not unite but leave a space about 2 millimeters wide. Eleven weeks after operation we found a thick continuous shadow in the region of the ulnar fracture and between the radial fragments. The radial fragments were embedded in the callus and were finally recognized as such. They stood about 0.5 centimeter apart and this defect was filled with a callous mass. At the edge of the distal defect there was in the radial callus a small separation extending to the compact bone. Histological examination of the preparation showed that the defect of the radius was filled by a periosteal callus arising from the periosteum of the radius.

In this place we would mention that the same conditions are of importance in the free transplantation of periosteum. If the periosteum in old animal is transplanted only the adventitia is used as has been previously explained and as the adventitia lacks osteoblasts it does not regenerate bone. Of this we have been able to convince ourselves many times in transplanting the periosteum in old individuals (that is adventitia alone). When the periosteum in young animals is transplanted and the proper technique is used bone is always present as the cambium cells remain hanging on the periosteum. An example showing the bone-building power of the periosteum in old animals when the above mentioned conditions are present follows.

In a man of 60 years the opportunity was presented during an operative procedure of a distal fracture of removing a small piece of the compact periosteum from the fracture end where it was possible to remove it easily from compact bone. This piece of periosteum

was transplanted subcutaneously and 14 days later removed. It was completely healed in and united with the surrounding tissue and had macroscopically built bone. In microscopic preparation (Fig. 1) one can see everywhere in the periosteum which is rich in cells marked osteoid and bone formation which extends into the hyperemic surrounding tissue rich in cells. The periosteum and its cells are united with the subcutaneous tissue of its bed by means of a granulation tissue. Here we have good bone reproduction with an autogenous piece of periosteum (with the cambium layer retained) in the subcutaneous fatty tissue in an old man.

A further proof is found when a nose is made by transplanting an autogenous periosteal covered piece of bone from the tibia. The bone is first transplanted free into the subcutaneous tissue of the arm. In such cases according to Lexer the bone when transplanted free in the soft parts quickly begins active building and destruction and everywhere the osteoblasts of the periosteum and also the endosteum form new bone.

Figure 8 is from such a case of nose plastic. A section of a small piece of bone was taken from the healed in bone 4 weeks after the implantation in the upper arm. The processes mentioned above can be recognized readily. Especially noticeable is the definite covering of the bone on its periosteal side with a layer of intensely colored typical osteoblasts and in addition in the marrow spaces are areas of erosion caused by giant cells which lie scattered in the deep bone.

To secure bone production by means of the periosteum it is necessary to maintain the natural union of both layers of the bone and also to retain its osteoblastic layer. According to Lexer the adventitia plays a secondary rôle; it offers the osteoblast nourishment and protection; stimulus for bone formation does not come from it.

We were successful in all experiments in young and old animals when we followed the conditions laid down in the beginning and we obtained from the periosteal tubes functional normal regeneration which approached anatomically very near the normal. In these cases the inner architectural structure of the new bone assumed early the static relationship (compact bone with the lamella in the outer layer running longitudinally, the spongy bone with irregularly arranged lamella and marrow spaces see Fig. 2). In the regenera-

tion of bone from a periosteal tube the endosteum expends its energy in forming a new marrow canal in the periosteal callous mass and it is through the activity of the osteoblasts and osteoclasts that the new marrow canal is made (compare Fig. 2).

We were also able to determine that from partly retained periosteum there is sufficient bone regeneration to be of functional use.

A young rabbit was operated upon with the usual technique and a cylinder of compact bone and marrow canal was removed. At the same time a half circle of the periosteum was removed and the marrow canals of the stumps were curetted. Figure 9 shows the defect (immediately after and three months after operation). Three months after operation both stumps were united by a uniform bone shaft which on the outer side showed a concavity. Radius and ulna were united by means of a bridge like callus. Histological examination showed a filling in of the defect by means of well formed bone from the retained periosteum. The outer layer is of a compact structure the inner layer is spongy. In this case histologically there is also a new formation of periosteum where the periosteum was operatively removed.

In our experiments we were able to substantiate the powerful regenerative action of the periosteum. Periosteal defects regenerate in the shortest time either from the cut edges of the remaining periosteum or from the islets of remaining periosteum and finally from the endosteum of the haversian canals lying superficially in the cortex provided the place of periosteal regeneration is not closed up by the early proliferation of the surrounding unspecific connective tissue. From such periosteal regeneration bone defects in which the periosteum has been operatively removed and in which the remaining bony tissue has been removed (as numerous experiments show) can be united in a very satisfactory anatomical and functional way (experiments with endosteal cylinders see below). The periosteum has such an ability to regenerate and build bone that its thorough destruction would be necessary to prevent bone formation. In all the experiments in which the periosteum was removed but the remaining bony structures were kept intact and in which there was a total loss of periosteum compact bone marrow and endosteum the periosteum in a short time forced its way through in all directions.



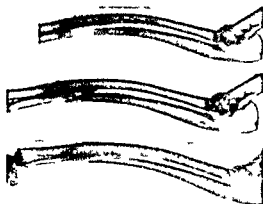


Fig 1 Circula comp tbon marrow d t um  
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aft operat n n l 2 and 2 d s l t

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the def ct how no callus After 12 l y the nt  
genogram shows th light h l of th tump  
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centrally a 2 centimeter long irregular cllu h l  
ow The d fect is not brig l by th llu n  
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ulnar fragment and the ralu n l a m l e x t i  
on the ralu s oppo ite th perih eral ul ar frag  
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border of osteo d cell of th callus b l n l n t  
compartment like conn ctiv t u e rich in l l  
r ach g out in all f e ction v h i c h a v t h a n t  
formed the precallous stage The blood suppl of  
this con ctive tissue like marrow an l n l t um  
part becomes more parse outside of th allous  
r dge Taking part in the forming f o n n ctiv  
t u e of the defect is the unspecif connecti t u  
of th surround ing parts with innu m at l l l s  
and blood vessels Oppo ite th perih eral fr gm nt  
and its my logeno-endo teal callu i a p e i t e l  
callous mass of the rad us an l b y m e a n f e r t i l g  
this is united with the ulnar f l g m t m ch an ical  
influence of m v e m n t Some l t a n c e f m t h  
stump en l the p r i o t e u m has r e g n r a t e l n l  
forme l a callu

5 mil r but much farther a l y n e l p r o c s a r e  
found in experiments which wer follo l for a  
longer t m in a young large dog in h i c h in the  
usual manne a 2.5-centimeter p e e c e of periost um  
and compact bone wa t k e n from the right ul a  
with the marrow and endosteum intact The p e o  
teum was remov l from th fragment and the  
nut rient ar ry saved pl ster f Pa is d r e g a s  
applied and worn for 4 weeks Figu e 13 sho s the  
defect immediately after the operation and 3 and  
10 weeks after operat on A cloudy sh a l o about



l l r e f t i f b u p e m t l w n  
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t g t t l n l K r l u

l l r l l g a n l t h f the fragment  
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l t t h m a v p a of about 8 millimeters h i c h  
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p r i t u a n l a r cover l b y the im m e d i a t e s u r  
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p l c e of p e r a t i o n th p r o t e u m has r e g n e r a t e l  
l n t h b e n l j u t a in the cases m n t i o n e d  
l f r

While from the marrow and endosteum cyl  
inders only an incomplete filling of the defect  
with bone took place we could show in our  
experiments that from the periosteal re ts a

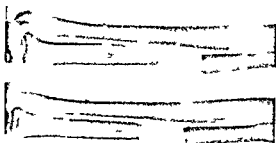


Fig 3 C e l r b o e m r w a d n d t u m d e f c t f  
d y p c a t A r t y d s t o v l n j m w c n l  
p l g d t h l g u t g o b o k n i g r g m  
taken m m l a t l y a f t e r o p e r a t o a d m t h l t





Fig. 1. Eut. nut. npl. t. f. thick. ed. l. 6  
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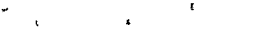
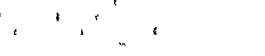
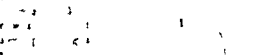
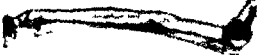
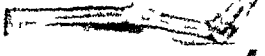
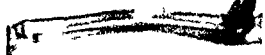


Fig. 2. Eut. npl. t. f. thick. ed. l. 6  
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 I. e. k. s. f. t. o. p. a. t. n. the. i. ma. k. e. d. b. u. i. l. d. i. n. g. a. d.  
 destru. t. i. f. b. o. e. O. Ost. b. l. s. t. s. P. p. r. i. s. t. e. a. l. s. t. e. o.

hyperemia and callous formation. Since the bone formation sets in just at the end of the marrow canal the nutrient arteries at this place are gradually compressed and are soon shut off. For this reason the blood supply to the marrow and endosteum lying outside of the marrow canal is decreased even before bone building can begin. The supply of nourishment is completely cut off as soon as the marrow canal is completely closed by the callous mass. A result of these processes is the forming of pre callous masses from the marrow and endosteum which set in later near the middle of the defect. In the middle of the defect for reasons previously stated the decreased blood supply makes itself evident even before further development of the callous masses takes place.

Now we know that the delicate callous masses are hindered in forming bone when nourishment is interfered with through mechanical stimuli. Such mechanical stimuli are

not entirely prevented due to the nature of the experiments even when plaster of Paris bandages are applied. Even the continuous pressure of the surrounding soft parts and muscles as well as the slight movement (impossible to prevent) of the fragments causing laceration and rubbing of the cylinder of marrow and endosteum and its blood vessels is sufficient in this extraordinarily sensitive cylinder of endosteum and marrow to cause tearing of the nutrient blood vessels hemorrhages necrosis or even tearing and breaking off of the cylinder of endosteum and marrow. If the cylinder of endosteum and marrow is not damaged from the beginning by these things and callous masses form in the defect the callous masses will degenerate into connective tissue degeneration products as a result of the poor nourishment due to the diminution of the blood supply caused by the unpreventable mechanical stimuli. The marrow callus as a result of its early development in



1. The first leg is the most common form, with a long femur and a short tibia. The second leg is similar, but the tibia is slightly longer. The third leg is similar, but the tibia is even longer. The fourth leg is similar, but the tibia is even longer. The fifth leg is similar, but the tibia is even longer. The sixth leg is similar, but the tibia is even longer. The seventh leg is similar, but the tibia is even longer. The eighth leg is similar, but the tibia is even longer. The ninth leg is similar, but the tibia is even longer. The tenth leg is similar, but the tibia is even longer. The eleventh leg is similar, but the tibia is even longer. The twelfth leg is similar, but the tibia is even longer. The thirteenth leg is similar, but the tibia is even longer. The fourteenth leg is similar, but the tibia is even longer. The fifteenth leg is similar, but the tibia is even longer.

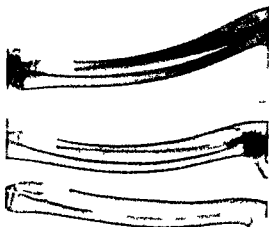


Fig 1 Cylindrical compact bone and periosteum of tibia in 30 g rabbit. Periosteum scraped off section on stump. Roentgenograms taken immediately after operation and 12 and 32 days later.

tion poorly nourished or areas of unspecific connective tissue of the immediate vicinity which on account of the continual actions of mechanical stimuli lead to complete replacement by connective tissue and therefore to pseudo-arthritis.

Where the blood vessel supply is intact the condition necessary for bone regeneration in a marrow endosteum cylinder is unfavorable. The conditions become especially bad when the nutrient artery is destroyed. The hyperaemia in such cases cannot develop at the proper time but develops only when the collateral circulation in the marrow endosteum cylinder has developed. According to the investigations of Lexer these processes take about 4 to 5 weeks. In this time the marrow canal in the defect is closed either by the periosteal regeneration and bone formation if the periosteum has not been thoroughly removed or from the connective tissue of this region. For these reasons the delayed callus of the marrow and endosteum cannot develop. Increasing the time of fixation is not necessary in as much as a bridging of the defect takes place from the periosteum. The myelogenous endosteal bone formation results in such cases only inside of the marrow canal. In comparison with the cases in which the nutrient vessel is intact the myelogenous endosteal bone regeneration is very little.

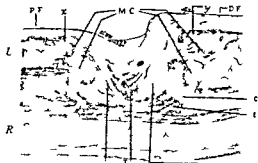


Fig 2 Diagram of section of bone from same experiment as in Figure 1. P F Proximal fragment. M F Middle fragment. E F Endosteal fragment. C F Compact bone. A F Articular surface. S F Soft tissue. D F Defect. R F Resection. T F Tissue. U F Ulcer. V F Vessel. W F Wound. X F X-ray. Y F Yaw. Z F Zygote.

As an example of these conditions we will show the pictures of a young rabbit in which a cylinder of compact bone and periosteum retaining the marrow and endosteum was removed from the ulna and the nutrient artery destroyed. The periosteum was scraped from the end of the stump 0.5 centimeter in length. The wound was sutured and a plaster-of-Paris bandage put on and worn for 4 weeks. Figure 15 shows the condition immediately after operation 15 days later and 6 and 10 weeks after operation. At 15 days there were shadows deposited on the outer surfaces of the compact bone but not on the inner end area of the marrow canal. On the inner side of the radius the callus was a bowl-like roughened callous mass. After 6 weeks the shadowy layers on the outer side of the compact bone of the radius and ulna united. After 10 weeks the defect more completely filled out with callus except on the outer side of the ulna where there is still a small place not filled out. From the histological picture (Fig 16) one can recognize by comparing with earlier case (Fig 2 and 14) the extraordinarily slight myelogenous endosteal callous formation at the end of the marrow canal which are slightly covered by the callous formation and toward the defect are beginning to be closed off. In a very definite way one can see the great vicarious periosteal regeneration and callus formation which has filled the whole defect. The inner structure of the periosteal callus is far advanced (compact like structure on the outside spongy structure inside). At the same time one can see that at the peripheral fragment and in the defect the periosteal blood vessel which are forgoing in a way through the callous mass are taking part in the vascularization of the marrow canal.

In a series of experiments with intact marrow and endosteal cylinders in which the nutrient artery was destroyed the unspecific connective tissue of the surrounding structure





Fig 13 Circular compact bone a periosteal defect of ulna in young dog. Periosteum repaired 2 centimeters on stumps. Roentgenograms taken immediately after operation and 3 and 6 weeks later.

grew more or less into the marrow canal. In such cases bone formation may take place as a result of the delayed regeneration of the marrow and endosteum where the infiltrating connective tissue stops that is more or less deep in the marrow canal.

The process of bone regeneration is slower in older animals than in younger animals. Unlimited mechanical stimulation which results from a free use of the limb (no plaster of Paris splint) from the beginning damages quite markedly the sensitive marrow and endosteum and as a result much less callus is formed than in animals in which this damaging mechanical stimulus is reduced as much as possible by means of plaster of Paris bandages. Further more the free use of the extremities in the first weeks (no plaster of Paris splint) has a delaying influence upon the bone formation in the early callous tissue.

### 3 THE RÔLE OF COMPACT BONE IN BONE REGENERATION

From our experiments we can conclude that compact bone inasmuch as it is robbed of its periosteum and marrow and endosteum and by thus of its nourishing blood vessels is attacked by the infiltrating connective tissue from the immediate vicinity and becomes porous. If nourishment is not very quickly supplied from the neighboring periosteum or marrow and endosteum spontaneous fracture will result in such pieces of compact bone especially under the influence of function and weight bearing. *The cortex denuded of periosteum and marrow and endosteum does not take part in bone formation.* On the other hand we could prove that as the denuded compact bone was again nourished periosteal regeneration and bone formation took place from the osteoblasts of the haversian canals.

As proof of these statements we wish to present the roentgenograms of a case in which the periosteal covering of the tibia was entirely removed from this piece free from periosteum the front wall of bone together with the marrow and endosteum was removed. In this case for a distance of about 2 centimeters there was only the posterior shell of compact bone free of periosteum marrow and endosteum. It remained undamaged but the fibula was bent in. The wound was sutured and no plaster of Paris bandage applied. Figure 17 shows the condition immediately after the operation the defect of the anterior tibial wall and opposite the shell of compact bone of the tibia a horizontal fracture line in the fibula without displacement. The posterior shell of compact bone of the tibia is not fractured. After 7 days (Fig. 17) small callous masses can be seen on the outer surface of the lower end of the compact bone the posterior shell of the compact bone shows nothing of especial interest. After 16 days (Fig. 17) one can recognize the callous formation on the tibial fragment spontaneously fractured. Between fibula and tibia there is a callous bridge. Histological examination showed that atrophic and degenerated posterior shell of the cortex and callous formation only when periosteum marrow and endosteum were retained therefore only to the base of the shell of the compact bone.

As a further example we wish to show the roentgen pictures of a case in which a 2.5 centimeter piece of periosteum compact bone marrow and endosteum was sawed out of the radius at the same time the nutrient arteries were destroyed and the periosteum on both stumps removed to the joint ends (total defect). The wound was sutured and plaster of Paris bandage applied and worn for 4 weeks.

Figure 18 shows the defect immediately after the operation and 4 weeks and 14 weeks later. After 4 weeks the stump is shown as healed out light and has low no callus. After 14 weeks the stump is at regular points and has a high grade atrophy but no callous formation. Microscopic examination shows a 1 centimeter thick zone of tissue and an atrophic cortex which is very thin and unspecific connective tissue from the neighborhood. At isolated places could be seen small partial islands which had developed in the outer surface of the bone grown out from the haversian canals between the connective tissue.

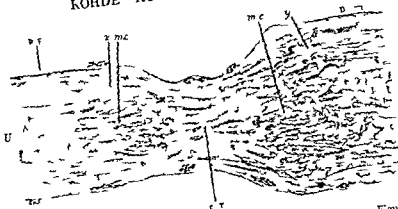


Fig 14 Drawing of section from same experiment as shown in Fig 12. F Proximal fragment, U site of operation, M C myelogenous endosteal callus, D F distal fragment, C T connective tissue defect (marrow and endosteum) and connective tissue of continuity, L ul

## 4 CIRCULATORY SYSTEM AND BONE REGENERATION

This question can be answered only in connection with sections 1 and 3. In a resume the following will again be stated. Every bone regenerative process is intimately associated with an undamaged blood supply to the osteoblasts and at the seat of the lesion with a fracture hyperemia setting in at the right time and continuing undisturbed for a sufficient length of time. If the circulatory supply is primarily damaged or in the course of the regenerative process too early destroyed bone regeneration does not take place. Such damage depends especially under the influence of undesirable mechanical stimuli are replaced to a certain extent by the degeneration of the part and partly by the connective tissue of the immediate vicinity.

Damaging the blood supply leads to pseudarthrosis. Conditions are unfavorable with reference to marrow and endosteum even when operatively the blood supply is retained. Through its own callous formation at the ends of the marrow canals the ends of the marrow and endosteal tubes lying in the defect are early cut off from their source of nourishment. In substantiation of Lever's findings we could prove that after damage to the vascular supply of the marrow and endosteum the periosteal circulation takes a part in furnishing a new supply in that perforating blood vessels grow through the cal-

lous mass or through its own callous mass into the marrow canal (Fig 16)

## 5 BONE REGENERATION AND CONNECTIVE TISSUE

In our experiments we could prove the view point of Lever that the connective tissue may be derived from two sources: first from the connective tissue of the periosteum marrow and endosteum second from the immediate surrounding connective tissue.

We have already explained that the periosteum as a whole when it is separated from its source of nourishment (blood supply) undergoes connective tissue degeneration. As a result of cutting off the fracture hyperemia it cannot reach the cambium layer at the right time and the cambium layer is badly damaged and can build no bone. In such cases the stump ends are covered by connective tissue resulting from the periosteal degeneration while the defect itself is bridged by this connective tissue (Fig 4). In the same manner the adventitia and the connective tissue of the fibroelastic layer can under the bony union and bridge the defect by means of a connective tissue strand if the cambium layer is separated from the adventitia and fibroelastic layer (periosteal tube old animals Fig 5). The gradual pushing forward of the callous formation which in such cases comes from the cambium layer which has retained its normal relationship blocks in one way or

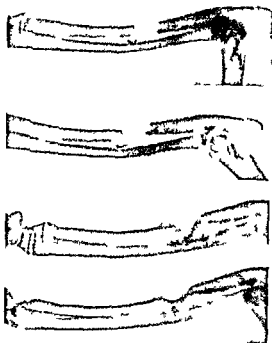


Fig. 15. Circula p r s t m d e compact bo d f t  
fuln in y ung r b l t f e n s t s c r a p e d o f f t m p  
e d o s n t u m e t R o c t g g r m t k e m m d t l y  
f t e r o p e a t n d s d a y n d 6 a l o c e k l a t

another the previously formed connective tissue of the periosteum because it sinks into the small corner holes and the defect early and fills them out. The adventitia grows if the regeneration of the cambium layer is interrupted by hemorrhage or the too early closing off of the compact bone through the unspecific connective tissue of the surrounding tissue forming a covering over the stump ends. The mushroom like callus of the marrow and endosteum plays a part in the formation of the connective tissue of the defect. In the same manner the adventitia may cover up the marrow canal or grow into it if a myelogenous endosteal callous formation does not take place at the right time. At places of especial mechanical stress the connective tissue like stages of periosteal callus remain a long time and develop into areas which are gradually replaced by bone (Fig. 10).

From the marrow and endosteum connective tissue develops in places where the nour-

ishment is limited or in those places where damage has resulted to the marrow and endosteum or its blood supply by undesirable mechanical stimuli. Under the influence of such disturbance bone formation does not take place in the already formed precallous tissue. From the marrow and endosteum there develops into the defect because of impairment of the blood supply of the nutrient artery a tissue rich in cells which gradually changes to a fibrillary connective tissue. These same processes take place in the marrow canal if the nutrient artery is destroyed during operation. In such cases connective tissue formation begins deep in the marrow canal and extends out of the canal and advances into the defect. Developing in one way or another such myelogenous endosteal connective tissue takes part in the formation of the connective tissue of the defect (Figs. 1 and 14).

This connective tissue resulting from the regeneration of the different tissues of the bone is increased through connective tissue which arises from the unspecific connective tissue of the surrounding region. Where larger periosteal defects, destruction of the cambium layer or damaging of the circulation hinder beginning regeneration at the right time by the specific bone building cells the unspecific connective tissue of the immediate area grows too early into the spaces (Fig. 4 and 5). Especially in this case when at the same time damaging mechanical influences may be present. Thus the unspecific connective tissue of the vicinity unites with the connective tissue of the generation of the periosteum as explained above as an obstacle to bone formation. Where the periosteum is loosened or removed from the compact bone the blood and lymph vessels of the vicinity become organized by the connective tissue so that at a later stage the outer surface of the bone is everywhere attacked by granulations and covered by the usual connective tissue (Figs. 12, 14, 17, 18 and 20). In such cases the unspecific connective tissue of the vicinity because it develops earlier than the processes of bone regeneration is a hindrance to regeneration and bone formation. At these places the incompletely regenerated cambium layer overcomes for a short

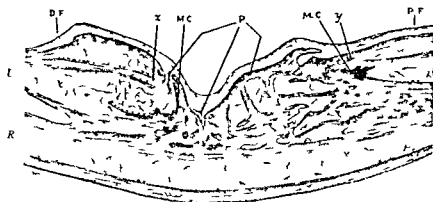


Fig 6 Dry g fsect n fb in me e p m nt th tsh in Figur 5  
D F D tal fr gme t A l te f perati n M C m l gen nd st l callus  
P reg erated peri teum with c ll l pe t al blood ess l P F pro im l  
fr em t L ulna R radiu

distance the un pefic connective tissue a  
u less attempt of the un pefic bone regen  
eration which results in a victory of the con  
nective tissue and the destruction of the osteo  
blasts The un pefic connective tissue of the  
vicinity wanders far into all the defects of the  
marrow and endosteum (Figs 1, 18 20) and  
or nizes the blood and lymph pre ent there  
In the early developed connective tissue  
specific bone regeneration by the marrow and  
endo teum find an unsurmountable difficulty  
Furthermore we could prove that with an  
intact cylinder of marrow and endosteum the

part of the cylinder in the defect is replaced  
partly by connective tissue developed from  
it elf and partly from granulating tissue of the  
vicinity (Fig 12 14) For the mo t part it is  
the damage of the marrow and endosteum as a  
re ult of cutting off its blood supply in addi  
tion to damage hemorrhage and necrosis as  
a result of being early damaged which causes  
the growing in of unspecific connective tissue  
in the vicinity of the damaged places In  
later st ages the fibers coming from the marrow

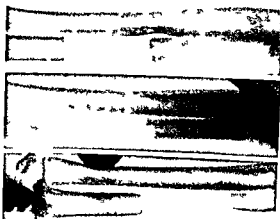
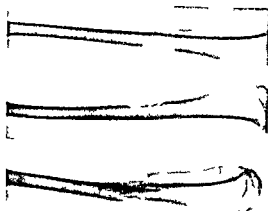


Fig 17 Pe t l r g nlm rro d l t  
d fect of b t su grabl t l r tu fll l p t  
t a t sh ll f t b a l e t ng m t ke m m l l l  
alt r operati nd ya d 6 d ys lte

l k S Sl k th t t l d fect of t l r du (25  
ce t m ters) in 30 g cat These roentgen anms vert  
l k mme l t l y ft r the ope t a d a l 93 ks  
l ter

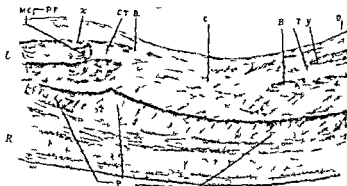


Fig. 8 Drawing of section of bone in same exposure time shown in Figure 9. P F Proximal phalanx X site of operation C T B cortical bone D defect B compact bone D F distal fragment P D periosteal defect M C myelogenous endosteal callus U ulna R radius

and endosteum from the periosteum and from the connective tissue of the vicinity permeate everywhere so that the defect is completely filled by a firm scar tissue coming from different places. As a result of connective tissue degeneration of the bone building tissue itself or as a result of its replacement by the non specific connective tissue of the vicinity pseudo-arthritis develops the latter however is due to nutritional disturbance of specific bone building parts or due to far reaching damage and separation of its osteoblasts.

If the nutrient arteries are intact and cause the myelogenous endosteal bone building to set

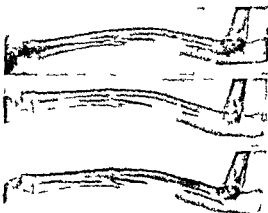


Fig. 9 Total defect of ulna in young rabbit. Roentgenogram taken immediately after operation and 8 days and months later.

in at the right time the mushroom like callous masses will be covered under certain conditions by non specific connective tissue of the vicinity together with periosteal connective tissue (Fig. 12-14). The fibrous degenerated remains of the marrow and endosteum lying between mushroom like calluses of the marrow unite with the periosteal and unspecific connective tissue and form a connective-tissue bridge between the incompletely regenerated bone stumps. If the nutrient arteries are destroyed the connective tissue of the vicinity granulates into the marrow canal and fills it more or less before a myelogenous endosteal callous formation can take place after the collateral circulation has developed and started regenerative processes. Finally after development of the collaterals we have seen delayed callous formation in small amounts from the marrow and endosteum. In its further growth the callous formation will be hindered by the previously developed masses of connective tissue. In such cases with destroyed nutrient arteries but with intact cylinders of marrow and endosteum the replacement with unspecific connective tissue of the vicinity goes so far that not a trace of marrow or endosteum can be demonstrated in the defect. As a result of the destruction of the blood vessels in such case the marrow and endosteum remain only deep in the marrow canal and otherwise are replaced by the non specific connective tissue of the vicinity.



Fig 2 Implantation of a boiled infected piece of bone into the muscles of a young cat. After 6 days we find a sharply defined bone with fibrous tissue in FC growing into the marrow spaces. With you granulation tissue GT in the outer surface of the development of this tissue into osteoblasts is a bone building process.

Compact bone which had its periosteal covering as well as the marrow and endosteum removed was covered on all sides by a non specific tissue coming from connective tissue of the vicinity and as a result of its absorbing influence the bone becomes porotic. Before regeneration can set in from the edges of the remaining periosteum marrow and endosteum the non specific connective tissue of the vicinity has attached itself everywhere and strands in the way of every progressive regenerative process of the specific bone building parts.

These processes were previously demonstrated by a series of experiments (Fig. 1, 14, 15, 18). We wish to elaborate them through illustrations from an experiment in which a young rabbit a cylinder of periosteum compact bone and marrow and endosteum a centimeter long was removed from the upper third of the ulna and centrally and peripherally a small section of bone and marrow and endosteum was removed. At the end of the operation a fragment of the half of the periosteal fragment developed just within the joint over the periosteum. Sutured. A fragment of Paris plaster was applied and in 4 weeks the bone was healed. The bone immediately after operation and 4 days and 1 month later. After 1 month the central fragment united with the radius by means of all the tissue that was left. The bone building process at the fracture site was the same as the bone building process.

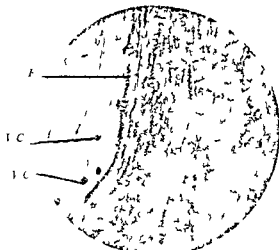


Fig 3 Implantation of a boiled sterile piece of bone into the muscles of the back of a young rabbit. After 9 days we find a sharply outlined bone with FC growing into the marrow spaces. With you granulation tissue GT in the outer surface of the development of this tissue into osteoblasts is a bone building process. The result is a complete lack of marrow in the bone.

stump. Histologically (Fig. 20) we can see how the outer surfaces of the compact bone are well lined and everywhere eroded by the non specific connective tissue. The same is true with reference to the bone freed from marrow and endosteum. One can see how the non specific connective tissue of the vicinity has grown into the marrow canal. At the peripheral fragment (complete removal of the marrow and endosteum) the whole marrow canal is filled by the connective tissue of the vicinity while the central fragment (marrow and endosteum retained) shows in contrast a small amount of callous formation deep in the marrow canal in advance of the connective tissue of the vicinity which has grown in.

On the other hand we could confirm that wherever the periosteum or marrow and endosteum were well nourished and returned and where the fracture hyperemia could develop unhindered bone building results through the specific bone building activities of the osteoblasts. In such cases small blood or lymph exudates could not hinder the specific bone building regeneration. However the blood and lymph exudate do not offer the best conditions for bone building and the best regeneration sets in where no extravasation of blood is present. Extravasation of blood always has a damaging influence when the bone building tissues have been disturbed or their source of nourishment interfered with. At



Fig. 23 Implantation of a boiled piece of bone into the abdominal cavity of a young dog. After 23 days we see the highly calcified bone surrounded by network of fibrous connective tissue. The white horizontal lines at the periphery represent the space of the trabeculae. No haemorrhage, osteoblasts, and no bone building process.

Fig. 24 Higher magnification of the section from Figure 23 showing the lamellar structure of the dead bone by the connective tissue of the host.

these places the extravasation of blood is very early replaced by the non-specific connective tissue of the vicinity and forms scar tissue which is an insurmountable difficulty for beginning bone regeneration which sets in late. These views of Lexer are confirmed in our animal experiments.

Furthermore it develops that under the influence of undesired mechanical stimuli the tissue of the non-specific connective tissue of the vicinity predominates. These facts in connection with similar facts regarding the periosteum, marrow and endosteum as explained previously cause us to see in our animal experiments a further proof for the views of Lexer that the first weeks are very important for fracture hyperaemia and bone regeneration and mechanical stimuli should be eliminated as much as possible.

At the same time important conclusions can be drawn from our regeneration experiments with reference to the question of metaplasia which will be considered more fully in the following section. The connective tissue elements of the periosteum, the marrow and endosteum as well as the non-specific connective tissue of the vicinity never develop through metaplasia

into bone. Not once in these experiments in which the connective tissue like granulations of the marrow and endosteum seemed to meet with those of the periosteum did bone formation appear. The connective tissue through metaplasia takes no part in bone regeneration. Bone is formed more readily when the specific bone building cells (osteoblasts) undamaged and in normal relationship with their blood vessels are present. These last findings in a certain measure form a basis for the following section.

## II. POSSIBILITIES FOR BONE REGENERATION FROM METAPLASIA OF THE CONNECTIVE TISSUE<sup>1</sup>

In the first part of our paper we have endeavored to show that the metaplasia of the connective tissue into bone has very little to do with regeneration. As a result of our experiments we have come to the conclusion that under certain conditions (damage to the osteoblastic tissue or its circulation) scar tissue develops out of the pre-osteoblastic tissue of the periosteum or marrow and endosteum.

<sup>1</sup>These experiments were performed by Dr. H. P. M. B. Bock (Lier Foundation).

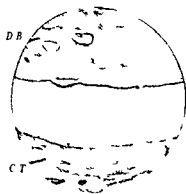


Fig 25



Fig 6

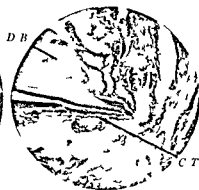


Fig 7

Fig 6 Implantation of a piece of bone in a sterile field 4 days with the section into the ducts of the thigh of a 30 g rabbit. After 14 days we find dead bone with

empty space. DB concentrated along the edges of the bone. GT is the rest of the bone. The dead bone is surrounded by connective tissue. Fig 7 Implantation of a piece of bone which was kept cold in the refrigerator for 4 days. The infection into the bone led to the formation of a young rabbit. After 2 months we find dead bone DB surrounded by connective tissue. The use of the highly rich CT with no chondrocytes and no bone building processes.

and therefore a pseudarthrosis results. If these traumas are not present out of this same tissue cartilage, osseous and bony tissues are developed as a regeneration. On the other hand we have come to the conclusion that in bone regeneration metaplastic bone building by the connective tissue does not take place. From the practical standpoint there are different viewpoints while most authors as a result of clinical and experimental experience with bone transplantation use living bone with retained periosteum, marrow and endosteum because in this way alone on account of its osteoblasts it heals in and forms a living substitute. There were earlier investigators and some today who used dead or inorganic material. They argue that to a certain extent through metaplasia of non-specific connective tissue of the vicinity a bony substitute of the dead may be obtained to serve as a beginning. Marchand, Barth and Lexer were the first to use dead bone and bone ash experimentally and clinically in transplantation and treating fractures. Marchand went a step further and used the different elements of the bone which were synthetically prepared. The use of such synthetic preparations of the elements of the bone has been experimentally and clinically investigated recently by Cotton. Marchand

and other older investigators limited themselves for the most part to the use of calcium carbonate and calcium phosphate. Cotton uses in addition urine salts or their chemical equivalents and also magnesium and its salts in transplantation and in the treatment of fractures (delayed union of fractures). The injection of insoluble calcium salt according to Cotton offers the best outlook while the practical worth of magnesium and its salts is limited for because of the changing of the magnesium in the tissue hydrogen is liberated which damages the tissue. Cotton has successfully used the synthetic preparations he advocates.

All these materials—living, dead bone elements of bony tissue synthetically prepared salts of bone—are used in bone formation through the activity of the osteoblasts. As several authors maintain these materials should at the same time stimulate the non-specific connective tissue by a metaplasia into bony tissue. Advocates of the metaplasia theory with reference to bone formation are Ollier, Orth, Gruber, Baschkerzew, Petrow, Nemlow, Nageotte, Regard, Bancroft, Weidenreich, Simon, Ferranni and others. Under no consideration can absolute proof for such statements be taken from cases in human







Fig 31



Fig 32



Fig 33

Fig 31 Impl tat n of c lci f d m ss kept cool and teni f r 4 d vs witho t i fect n into the b ck m l s fa yo g rabbit. Afte 4 days we f d amorpho l c f d m s es C M s rro n d d by gra lation t G T of the surrou d g t i su rich n e lls w th g n t c lls G C G T Co ce t r c fibers in the e ternal t ta f the gran l t n t i su

Fig 32 Impl tat ion of sm ll c lci f d mass k p t cool nd steri l for 14 day th n f e t i o n to the b ck m s l e s fa yo g rabbit. Afte 2 months we f i d an am rph us

l i f e d m s s C M s ded by gr n u l t i o n t i s s e G T s r o u l t i s s and os on p r o c e s t h r g h g a n t l l G C The e no ch g e i to steobl t s nd n b o n b u l d g p o c e s

Fig 33 Impl tat i b r n e d bone nt the back muscl th f c t u fa g rabbit Afte r month e f i d b u r n d bone B ith gran lation t i s e G T of s r o d n g t e o u n d g i t rich in cell with i b r i l l r v f o r m t i o n The e no ch n g e into ost o l l s t a d b o n e b l d g p o c e s s

muscle tissue or infection takes part in bone formation our experiments on animals were so conducted The implantation area (back muscles abdominal muscles chest muscles upper arm muscles muscles of the calf of the leg temporal muscles tendons abdominal fascia subcutaneous tissue) into which the dead bone was to be transplanted was more or less damaged through tearing and crushing so that necrosis of the muscle resulted In another series of experiments the area of im plantation was infected at the same time in that the dead piece of bone was contaminated by the skin of the animal For implantation a piece of diaphysis 1 centimeter long was taken from the ulna or radius or a piece from a rib and killed in different ways In the first series of experments the pieces of bone were boiled 10 minutes then allowed to cool and implanted into the soft tissue of the same animal after they had been infected by the skin Because boiling of the bone is a coarse and unnatural killing of the bone in a second and third series in which the bone to be transplanted according to our view should have no living cells transplanted with it we kept this bone outside of the body 14 days after its removal In this time the ability of the

cellular elements to live and to proliferate is lost bone formation as a result is with certainty excluded The implantation material (bone with periosteum marrow and attached pieces of muscle) was removed sterile and either kept 14 days sterile outside of the animal body in a reagent glass excluding the air and without adding any fluid or other material in its own tissue juices at a temperature of 6 degrees Celsius (series of experiments No 1) or under similar conditions in an incubator at 37 degrees Celsius allowing autolysis (series of experiments No 3) The material prepared in this way at the close of its preparation was tested bacteriologically and only the bones found to be sterile were implanted in the soft tissues of the animals from whom these implants were taken 14 days before

In the sterile cold preparations there were no gross changes outside of the loss of life of the cells In the preparation where autolysis had taken place (keeping temperature at 37 degrees) there was a process similar to catabolism in the tissues The products of destruction which formed during the time the tissue was kept outside the body in both cases were present in a small amount of serum and



Fig. 34. Formation of the bone in the bone. A man in the laboratory, working with a bone specimen, showing the formation of the bone in the bone.



Fig. 35. Calcification of the bone. A man in the laboratory, working with a bone specimen, showing the calcification of the bone.

were in every case taken into account by transplanting the serum with the bone.

This catabolic substance must be considered and its rôle determined in estimating the metaplastic bone building power of the connective tissue as these sera are the carriers of the reactive and reparative processes in all healing and inflammatory processes.

Furthermore on the advice of Herr C. Schmitt Aschoff, director of the pathological institute of the University who examined our preparations and substantiated our findings, transplantation experiments with masses of tissue were begun. As is well known on metaplastic grounds these lead to heterotopic bone formation. As suitable experimental material the caseous chalky masses of calcified tuberculous glands from the hilum of a human corpse were taken out ten days after postmortem and kept for 14 days at 6 degrees in a resistant glass with the air excluded. At the end of this period the material was tested for fertility and that found sterile was implanted into the soft tissues of the animal. In these experiments no great growth changes took place during the time the material was kept outside the body except the destruction of life in a few cells.

While in these experiments organic and inorganic parts of bone were transplanted in

a fifth series of experiments only the inorganic constituents were transplanted (burned bones of the same animal). We did not transplant synthetically prepared inorganic or organic elements of the bone or decalcified bone. Because in our experiments we never found that bone developed in either autogenous bone, bony elements or other masses developed in the living body which have a tendency to metaplastic bone formation, so bone development is not to be expected from synthetically prepared bone or decalcified dead bone.

After the material which is prepared beforehand in one way or another is implanted into the heavily traumatized and damaged muscles, fascia, tendon or subcutaneous tissue, the soft parts were sutured together over the implantation. At different intervals the material including the surrounding soft parts was removed and studied.

As experimental animals we took rabbits, cats and dogs so that we might have several species of animal and thus obtain unbiased results. Rabbits as other investigators have established are especially suited for bone experimentation and therefore very quickly in the damaged muscle dystrophic calcification of the muscle bundles which spread rapidly. With this there appears a condition which in the pathology of heterotopic bone

formation very often precedes the real bone formation and in many cases helps to begin bone formation. In our rabbit experiments we have as a result of the spontaneous appearance of calcification of muscle bundles extraordinarily favorable conditions which imitates in a surprising way the natural bone formation of many cases of heterotopic bone formation.

If in any way a metaplastic bone formation takes place experimentally in the connective tissue of the muscles of the fascia of the tendons or of the subcutaneous tissue it must develop in those experiments which nearly approach the normal development. Because the activity of the osteoblast is less in older animals we have used only young growing animals.

The results of our experiments will be given before we go further into the discussion. Under the conditions set down for our series of experiments there is no metaplastic bone formation within an observation period of 5 months by the connective tissue of the muscles of the fascia of the tendons or of the subcutaneous tissue when dead pieces of bone of the same animal or a spontaneous developed dystrophic chalk mass are used. In the second and third series of experiments the material kept outside of the body with the extruded serum and its catabolic substances has produced no bone forming processes in the area in which they were implanted. At the end of our observation time (5 months) the cellular tissue of the host has completely disappeared. In a tough wide connective tissue covering the bone is encapsulated like a foreign body without attaining a more intimate union with the tissue of the host. The tissue of the host grows around and through it just as in porous foreign bodies (sponge or coal). From the third month on just as the histological studies show the process of healing is to be regarded as finished. By this time the dead transplant to a certain extent has been separated from the general body tissues by a tough wide tissue poor in nuclei (Figs 25 and 30). It is certain that observing for a longer time would show no change in the metaplastic ability of the connective tissue to form bone because from the third month on we have to

do with a closed process and with a transplant completely encapsulated by scar tissue not able to react. Under the conditions set down for our experiments we can conclude that there is no bone formation from the non-specific connective tissue. Not once does the attempt at imitation of the stimulus traumatic or infective given so often as the cause of growth in the pathogenesis of connective tissue formation in muscle result in bone formation. Indeed the spontaneous appearance of calcification of muscle in degenerated muscle bundles in the rabbit does not give the slightest ground for believing that bone-building processes take place but disappear again after several weeks through resorption.

The microscopic picture of boiled bones (Fig 21 and 5) in all stages shows a remarkably sharp edged contour of bone bound to the surrounding tissue by a sharp somewhat spread out border without any sign of gradual transition from one to the other. The union of the surrounding tissue with the bone takes place very slowly first through the deposition of fibrin from the surrounding tissue (Fig 21) and then by replacement of the fibrin by round cells and fibroblasts (Fig 22) and this union from beginning to end (loose cartilage) remains extraordinarily loose. Furthermore it is characteristic that the granulation tissue grows very slowly into the extraordinarily long retained marrow necrosis areas found in the marrow spaces and canals. Slowly are these replaced by granulation tissue and remain to the last as necroses of the marrow. At the same time it is worth mentioning that the bone cells stain well and that their dissolution is gradual. With reference to the marrow cylinder with its well retained ability to take up stain as well as to the bone cells the microscopic study shows with definiteness that these are dead protoplasmic masses and through cooking presents a fixed picture—irregular pointed contours of the cells and nuclei shrunken and deep dark stained nuclei.

The fixed cylinders of necrosis lying in the marrow canals and also the bone cells have shrunken together toward the center of the canal and in this way have lost contact with the bony wall (Fig 21). The vessels and cell

masses of the fixed necrotic cylinder of marrow lie in a light rose colored homogenous mass in a hæmatoxylin eosin preparation (Fig 21). These fixed cell masses even in the oldest preparations never show any evidence of life. As previously explained they are gradually resorbed by the granulation tissue of the host which creeps in. Even the fixed bone cells never show any division of the nuclei; the dissolution of the nuclei takes place slowly. These conditions depend upon the fact that through boiling a protoplasmic substance (fibrin) develops in which the dead cells are fixed and included. As corks these masses stop up the marrow spaces and bony canals and make difficult the creeping in of the granulation tissue and retard the splitting up and dissolution of the included cells and cell nuclei. This is the reason for the slow appearance and incomplete union remaining between bone and host. For the same reason the resorption of bone is small and is evidenced only in the form of small lacunar erosions (Fig 24). The giant cells which together with the other cells of the granulation tissue take part in the erosion are smaller than osteoclasts and seem identical in figure and form with the usual foreign body giant cells. In those late cases in which the bone is encapsulated as a dead porous foreign body and scarcely permeated by the tissue of the host the bone is very brittle and on sectioning with the microtome falls apart into its lamellar system (Fig 25).

Several findings which are important in the question of metaplasia and could lead to an incorrect diagnosis must be explained. In the first weeks especially in those cases not disturbed by infection the granulation tissue pressing toward the bone attaches itself to the bone with its fibroblasts and forms a cellular layer lying on the bone (Fig 21). Under the stimulation of the bone there develops here as Figure 22 shows an active nuclear division of the fibroblasts so that the nuclear content of the tissue on the outer surface of the bone is greater than at a greater distance from the bone. By superficial study of these fibroblasts standing close together on the outer surface of the bone we might consider the connective tissue cells as changed into osteoblasts especially in those places where these

masses rich in cells on the outer layer of bone sink into openings of the haversian canals (Fig 2). However after careful study there is not the slightest evidence to show that they are osteoblasts. These cells always retain their small spindle form figures their small spindle like and dark nuclei never take the vesicular form (also larger) of the osteoblasts with their large round and slightly colored nuclei. They lie perpendicular at first (Fig 21) and from the eighth day on parallel to the outer surface of the bone (Fig 22) and never lose their fibrillary structure (formation of delicate connective tissue fibers). Nowhere does a metamorphosis of the cells develop. From the fifth week on the multiplicity of cells which comprise the fibroblastic layer clinging to the bone disappear (Figs 23 and 4) so that immediately on the bone there is a fibrillary connective tissue which becomes poorer and poorer in cells and finally the bone is covered by a dense scar tissue (Fig 25).

In preparations up to 3 weeks there are seen the homogenous masses previously described between the dense fibroblastic layer on the outer surface of the bone which is the hæmatoxylin eosin preparation. These masses are colored light rose color (Fig 21). With a longer period of observation these masses are more and more replaced by the fibroblasts (Fig 22). These same homogenous masses as previously explained are also found in the marrow spaces and bony canals (Fig 21). They present toward the center of the canal shrunken fibrin cell and blood masses of the marrow and its capillaries. By superficial examination it is possible to regard these as young osteoid cells. Careful investigation especially the presence of fibrin shown by staining after Weigert and Kockel show these masses to be simply fibrin while the cells are either living fibroblasts of the host or else are shrunken dead cells of the marrow. In these preparations there is the usual fibrinous deposition from the host or fibrinous masses which on account of boiling of the transplant have fallen out of the marrow. These deposits of fibrin are rapidly replaced on the outer surface of the transplant inside the bone later and then only slowly by the tissue of the host. The preparations under consideration are the

same as one sees in the healing in of foreign bodies especially when it concerns porous bodies as long as the healing in process is associated with marked exudative processes and marked reaction of the tissues of the host

We have already mentioned that in the other series of experiments bone formation never occurred but that the *implants* of these experimental series are encased by the tissues of the host as foreign bodies by firm masses of connecting tissue (Fig 30) The processes of healing in take place for the most part as in the case of the boiled bones A detailed description need not therefore be given the reader is referred to the explanations given above On the other hand the differences which came to light in the various experimental series with regard to the processes of healing in must be more exactly indicated

The boiled bone fragments still display up to the third month quite extensive preservation of their nuclear staining (shriveled bone corpuscles and medullary cells) which result from a fixation caused by the boiling In contrast to this control experiments before implantation of the bone fragments which are preserved cool show that the various cell varieties of the bone have lost nothing in their form and capacity for staining through preservation with the exception of the periosteal covering and the immediately adjoining bone corpuscles Somewhat greater changes appear in the bones subjected to autolysis in that the staining power of the cell nuclei has somewhat diminished and in the marginal portions of the bone in greater measure than in the case of the pieces which have been preserved cool empty bone spaces or bone spaces with pale nuclear shadows occur In both cases (bone preserved cool and autolyzed) the attached muscle fibers are swollen without nuclei the fatty tissues dull the erythrocytes pale Thus in neither case has any decomposition of the dying cell and nuclear masses of the actual bone tissue taken place This rests upon the fact that the tissue fluidity necessary to decomposition is almost lacking

If now the bone fragments are replanted in the living bodies of animals changes very quickly set in In bones which have been preserved cold we find the bone spaces after a

fortnight passed in the living body of an animal completely empty while in autolyzed bones they are still partly filled after the same length of time has elapsed as in the cool preserved bones with nuclear shadows which in individual cases persist up to the fifth month as scarcely recognizable shadows in small splinters of compact bone In both cases (bone preserved cool and autolyzed) the periosteal tissue and endosteal tissue have completely disappeared after 14 days while the marrow tissue is still well preserved in so far as its structure is concerned but greatly bleached in so far as is concerned its color To the last necrotic fat remnants of the marrow and the surrounding soft portions persist as they plainly present greater difficulties to the surrounding tissue in their assimilation as a result of some sort of coagulation processes or decomposition products The surprisingly quick destruction of the nuclei which were still well preserved before the implantation is a result of the contact with the tissue fluid which in the living body continuously flows about and through the implantation and thereby makes possible the breaking down of the cells and nuclei

As to the reaction of the surrounding tissue we have mentioned the fact that in the case of the boiled bone fragments the invasion of host tissue takes place only slowly and in small measure exactly the same thing is true in the case of the transplantation experiments with calcified masses (Figs 31 and 32) In contrast to this the autolyzed bones (Figs 28 and 30) and especially with the bones which have been preserved cool (Figs 26 and 27) a very swift and very abundant penetration by the tissue of the host takes place This is due to the fact that the boiled bone fragments from the beginning resist the opportune access of the tissue fluid as a result of the closing of the bone spaces and small canals by coagulation products (the result of boiling) and for the same reason because of the obstruction of the little canals the cellular elements of the host can press forward into the boiled bone fragment only with difficulty Thus they offer greater resistance to the host and for that reason the encapsulating processes resulting from their influence as foreign

bodies naturally manifest themselves in these case in the form of early appearing bundles of connective tissue. The poor breaking down of the necrotic nuclei of the boiled bone fragments is related to the same processes.

In the cool preserved and autolyzed bones no similar closing of the marrow spaces by coagulation products takes place. Consequently they are more quickly penetrated by the tissue fluid and the cellular elements of the host with the result that there is a more highly developed relation between the transplant and the host. Upon similar grounds the absorption processes in the case of the cool preserved and autolyzed bone fragments are more strongly marked and are accompanied by a richer development of the giant cells. But in any case with all transplants the absorption processes remain unimportant and are soon exhausted so that at the close of the period of observation in all cases a bone only slightly eroded lies encased within a firm mass of connecting tissue poor in nuclei.

In the case of calcified masses (Figs. 31 and 32) there are more pronounced encapsulating processes in the form of fibrous formations than with the bone fragments which have been preserved cool or autolyzed. In invasion of cell from the host does not take place. The calcified masses are not decomposed but only on their periphery attacked to a limited extent by giant cells forming small lacunar erosions (Figs. 31 and 32) and encased as foreign bodies.

The porous carbon masses of charred bones (Fig. 33) permit a swift penetration of their hollow spaces on the part of the tissue fluid and the cell masses of the host. However no inner union with the host takes place here either only a light definite erosion of the bone early and marked encasing processes (formation of fibrils) and finally the imbedding in a firm fibrous mass.

While the absorption processes in the bone in all the various series of experiments occur only to a limited extent and appear as small lacunar erosions there are nevertheless differences in the absorption processes depending upon whether we are dealing with large small or very small bone fragments. The cellular reaction especially the number of

giant cells is notably greater around small splinters (Figs. 26 and 32) or the points of jagged pieces (Fig. 27) penetrating far into the tissue it continues longer and results in stronger erosion processes in the implants than around large especially compact pieces and in the case of the surfaces of smooth bone fragments (Figs. 28, 29, 31 and 33). Further more the formation of excluding bundles of connecting tissue sets in later around the small splinters or the penetrating points of bone than around large pieces of bone and flat surfaces.

Thus we arrive at the law that the smaller the implant or the more irregular its surface the stronger are the cellular reaction and absorption processes and the longer do they continue. This has its cause partly in the fact that small splinters or jagged bone points produce in the host a stronger traumatic irritation than the smoother surfaces of larger pieces of bone. In the main however the difference may be ascribed to the fact that small bone fragments or jagged bone points, have a relatively greater surface than larger smooth pieces and that therefore corresponding to the greater surface extent of the former the resorption processes are stronger here than in the case of the large smooth implants with their relatively small surface. However the possibility remains that small bone splinters can be resorbed by non specific connective tissue in larger bone fragments however the resorptive power of the connective tissue fails because of the mass (involved). In these cases the connective tissue accomplishes only an encasing (of the bone) as a foreign body. The situation here is exactly the same as in the transplanting of living bones into the soft parts when the osteoblasts of the latter have been destroyed by hemorrhage or infection. If the surrounding granulation tissue is still young, it acts resorptively on the bones as is well known. If however in such cases the bed has once been transformed into a capsule the remnants of bone remain intact within this scar tissue. The situation is similar with the healing in of dead transplants especially in heteroplastic work and in the use of fresh bones from cadavers in which cases the healing in of the dead substances proceeds with

out a trace of the atrophic stage which other wise sets in but with firm encapsulation<sup>1</sup>

In order to understand the reasons why in our experiments metaplastic bone formation on the part of the ordinary mature connective tissue of the soft parts did not take place and further whence and how the heterotopic ossification of the soft parts comes into existence more extended explanations are necessary. We know that in the course of the atrophy and decay of tissues they act upon the surrounding tissues and set in operation the whole series of resorptive and regenerative processes. At the same time they maintain the hyperaemia caused by trauma or infection which is the primary condition of all reparative and regenerative processes. Regeneration is thus immediately dependent upon the products of tissue decomposition. These products of tissue decomposition exercise in the tissue two kinds of activities specific and non specific. When they come in contact with living cells of their own kind they stimulate them to the creation of cells specific for that tissue and cell products or furnish them indirectly through hyperaemia with an increased supply of nutrient materials. On the other hand the decomposition products at the same time stimulate the living tissue of different cellular composition also to the creation of cells and cell products of its own variety. Both processes take place side by side. Healing of defects of whatever kind depends upon the question whether at the place where the tissues have been injured tissues of the same structure are present in sufficient quantity whether these possess sufficient vitality whether their vitality and capacity for regeneration has not previously suffered through obstruction of the channels of supply or whether on the other side the tissue of like cell structure has been injured or destroyed by the effects of trauma or infection or through obstruction of the channels of supply.

In one instance regeneration takes place out of tissue and tissue products of like cell structure in the other only a defective substitute produced by tissue of different cell structure

results in which case the non specialized connective tissue abundantly present in the body provides for the substitute and leads to the formation of a cicatrix.

Now these products of tissue decomposition are of especial importance for our investigation. In dealing with the question of metaplasia chemotropic and other irritating influences are still considered which are supposed to come from the living bone in process of decay and act upon the tissue of the host stimulating it to metaplasia and bone formation. Irritating influences are present their media are either trauma or infection but chiefly the decomposition products of decaying tissue. In the second and third series of experiments in order to test their capacities we transplanted the decomposition products which had separated out in the test tube along with the bones. For the rest in all the experiment series the decomposition products liberated in connection with the healing in of the living body through the breaking down of the transplants take part in the process. The question now arises upon what tissues these products of tissue decomposition act. Since Baschkirzew and Petrow deal with bone fragments transplanted living the decomposition products affect in the first place the living osteoblasts of the bone which are transplanted living along with it they stimulate them to regeneration thus bone formation arises from these osteoblasts. On these grounds as we have already mentioned bone fragments transplanted living in soft parts cannot be cited in proof of the capacity for metaplasia of the connective tissue in bones. Moreover we know in the pathology of pathological decomposition processes of the most varied sorts from living bones there is no ossification in the neighboring soft tissues. Unfortunately bones experimentally transplanted alive into the living bodies of animals cannot be brought as is desirable to a gradual mortification and decomposition in such a way as to eliminate the bone forming capacities of its osteoblasts. However one may mention the cases from human pathology also sup

Letter Twelve Transplantation von Knochenprodukten in weiches Gewebe

<sup>1</sup>Compare Knochenregeneration oder knochenartige Heilung von Frakturen von selb. F. Rohde. Leipzig 1906. On the subject of the formation of bone in soft parts see also Rohde Arch f. klin. Chir. 61, 1906, part 1 of 2.



purative bone transplantations in soft parts in animals in which in living bodies around bone fragments slowly dying on account of infection no sort of bone formation takes place in the surrounding soft tissues but in which the dead bones are occasionally removed from a granulation cavity by later operations or are spontaneously ejected. We have made histological examinations of such bones and the flesh in which they were embedded in a whole group of such cases and have never found bone formations.

If the capacity of osteoblasts of the transplants for life and regeneration are eliminated through appropriate experimental arrangements, the decomposition products of the bone tissues may act only on the cells of the host. In our experiments a bed was chosen which had no osteoblasts, thus regenerative processes caused by the litter did not take place. Only such processes were possible as led to the formation of tissues which were present and vital on the spot. Otherwise the connective tissue cells would have to be led back by the decomposition products and the tissue reaction sustained by them to an indifferent stage which would enable them to form also other derivatives of the connective tissue series such as *Knochen vorstufen* and bones. We take the standpoint of the anatomists that Dollo's law of the non reversibility of a development process once under way holds good for histology also. Cells which in the course of their growth have developed out of mesenchyme cells into ordinary connective tissue cells and have thus been so transformed that according to the anatomist Maurer they may be designated only as remnants of the original primitive cells, cannot again become differentiated so that they may revert to indifferent mesenchyme cells and from these develop into osteoblasts. In this process there disappears also the possibility of bone formation out of ordinary connective tissue cells. The implants and their constituent parts and decomposition products influence only the locally stationed cells to reactive processes under the influence of hyperæmia which in all experiments appears clearly in the first week. Thus there arises out of the connective tissue a granulation tissue with

connective tissue cells which at first are round and vesicular later become spindle shaped and which contently with their origin can develop only into a mass of connective tissue but never into *Knochen vorstufen* or bones. Our experiments show that very clearly.

From clinical observations as well as from our experiments we come to very definite conclusions namely that metaplastic bone formation does not take place from the ordinary connective tissue and that bone formation in every instance is to be attributed to specific bone forming cells (osteoblasts). The osteoblasts are formed either in the general development process through differentiation from the indifferent mesenchyme cell or they are formed after the conclusion of the tissue and organ development from osteoblasts which are present (*perosteum* and *endosteum*) through regeneration processes or they arise in a completely developed organism through differentiation of mesenchyme cells which have remained undifferentiated. From a study of anatomy and pathology (tumors) it is evident that even in a completely developed organism youthful embryonic cells with their manifold possibilities of development and differentiation may remain present throughout a whole lifetime and at an appropriate time may unfold their possibilities of development. Of course this holds good also for the layer of embryonic mesenchymal tissue. In the course of the tissue and organ development the mesenchyme develops into connective tissue, fascia, tendons, fat tissue, muscles, cartilage, bone forming tissue or bone. There remain here and there undifferentiated cell groups which do not participate in the further development of the organs. These unused mesenchyme-cells (*Stamm cells* after *Stohr* von *Vollendorff*) retain in themselves all their development potentialities. In later life if any kind of traumatic, infective or toxic irritation or metabolic disturbance affects cells of this kind they are brought out of their latent stage and are able within the limits of their peculiar development possibilities to differentiate themselves. Along with other derivatives of the mesenchyme series there may also occasionally arise out of such cells tissues of the bone series.

Heterotopic bone formation finds in this its explanation. As for parosteal ossifications Lever and others have always emphasized that not the ordinary perfect connective tissue formation but only very special adapted connective tissue formation permits ossification processes to arise. From our study we can understand this.

It is easily understood that in the immediate neighborhood of the bone structure unused mesenchyme cells remain and that under the influence of some irritation or metabolic disturbance these occasionally unfold their slumbering osteoblastic possibilities. Thus myositis ossificans circumscripta becomes comprehensible though it is to be observed here also that in a great number of such cases the cause is the tearing of the peroneum. Myositis ossificans progressiva is likewise to be explained by bone formation from unused mesenchyme cells which under the influence of metabolic processes develop their bone forming capacities. The histological proof of the transformation of such cells of the intermuscular connective tissue into cells with the properties of osteoblasts. Lever was able to produce years ago in his studies on myositis ossificans progressiva<sup>1</sup> Ossification of the Achilles tendon of many kinds of birds near the heel bone abdominal bone formation in the castration scars in animals and abdominal bone formations in man likewise penis bones in man are explained and are at the same time atavistic reversions.

With reference to abdominal bone formation in laparotomy scars we will cite two cases of our own. In the first case the patient was a 58 year old man with greatly enlarged abdominal veins in whom a carcinoma of the pylorus was resected. In the course of the after treatment a thrombosis of the greatly enlarged subcutaneous abdominal veins set in. Ten months after the operation there was observed in the patient who had made a magnificent recovery within an insensitve scar about four finger breadths below the xyphoid process a hardening about 6 centimeters long and 3 centimeters broad which a histological examination revealed as a formation composed of bone cartilage and connective tissue. It lay within the connective tissue of the abdominal fascia.

The second case was a 33 year old man who had had a gastro-enterostomy for duodenal stenosis. After 10 days in which no fever developed the

stitches were removed healing took place by first intention. The patient was up and about. The next day after operation or after stitches were removed a little hematoma drained. Twenty two days after the operation there was removed from the wound which healed *per secundam* a hard formation centimeters long and as thick as a match which had developed within the fascia midway between the umbilicus and the xyphoid process. Upon his logical examination (Fig. 34) there was found a well defined bone formation with several lamellar systems and detached marrow spaces. Besides completely formed bone there was cartilage osteoid and young embryonic tissue which proceeded from the firm connective tissue of the surrounding substance.

To both these cases of true bone formation in the abdomen in laparotomy scars we can add a third important observation. It concerns a 42 year old woman in whom 22 months previously a chronic appendix had been removed through a pararectal incision. Primary union of the wound. Twenty two months after the operation the patient came to the clinic on account of a painless hard mass in the operation scar which had developed slowly in the course of 3 months. At operation there was a stone hard mass in fibrous scar tissue of the abdominal muscles which was removed. Histological study (Fig. 35) shows inside the scar tissue consisting of spread out connective tissue bundles which have become hyalinized some normal muscle fibers and a larger number of calcified muscle strands. In the vicinity of this calcification there is an increase in the number of cells but no cell similar to osteoblasts and no bone building processes are present. In this case in spite of abundant calcification in the destroyed musculature there was no bone formation after 22 months.

It is known that in abdominal wounds and scars very often calcified deposits are found but no bone formation. The presence of calcium salts alone then cannot be the cause of heterotopic bone formation otherwise in the numberless laparotomies it would occur more often. In all tissue destroyed and in hemorrhage there is calcium deposition. If one considers how often these processes take place in different parts of the body which have a predilection for heterotopic bone formation (elbow upper arm thigh abdominal wall) and how extraordinarily seldom in these same areas bone formation in soft parts has been observed we are astonished at the importance and sometimes very great importance assigned to the deposition of calcium in the tissue in the pathogenesis of bone formation in soft tissue. The calcium salts are of importance only when they come in contact with osteoblasts or remaining mesenchymal cells.

If this contact is not attained even if the calcium salts are abundantly present no osteogenesis takes place in the soft tissue. The rôle of calcium salts in heterotopic bone formation in the soft parts and especially in bone pathology is of secondary importance. *Fundamental prerequisites for bone formation are living osteoblasts or unused remaining mesenchyme cells which can develop into osteoblasts.* These bone building cells without any spontaneously developed deposit of calcium salts and without artificially brought bone building substances can take the organic and inorganic substances from the living organisms which they need for building of bone. A measure of support to these processes through local or general diminution of organic or inorganic bone building substances may be allowed in certain cases of disturbance of the local or general calcium metabolism. A fact to be learned in advance is that the use of such things in the organism is not connected with a

damaged osteoblastic tissue which fact Cotton pointed out in the discussion of his magnesium injections.

As a result of clinical experience and our experiments we have come to the conclusion that after excluding tissues and organs bone building power is found only in specific bone building tissues (osteoblasts of the periosteum and marrow endosteum). Metaplastic bone building from the usual connective tissue of the musculature, the muscle septa, the tendons, the fascia and the subcutaneous tissue does not take place. Heterotopic bone formation in soft tissue is from the unused remaining mesenchyme cells which through traumatism, infection, toxic stimuli or disturbance of metabolism may abandon their in different stage at any time and commence to build bone.

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## BLADDER NEOPLASMS

BRIEF SERIES FROM THE DEPARTMENT OF UROLOGY ROYAL VICTORIA HOSPITAL

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Considering malignant growths of the bladder we find a great diversity of opinion both as to the pathology and methods of treatment. There are many classifications of these growths and many ways of dealing with the subject. Some authors depend entirely on the microscopical findings while others are guided mainly by the clinical picture. The great difficulty in the diagnosis by microscope is the transitional type of cell and the manner of growth. How often in every service do we find the laboratory report papilloma undergoing malignant change. Oertel contend that it is almost impossible to distinguish between a diffusely growing carcinoma and a sarcoma in the bladder. But the difficulties are not confined to the microscope. The clinical diagnosis has also its problems.

In 1922 Lower reviewed so thoroughly the classifications of Buerger, Geraghty, Judd and Harrington, Barringer and the end results of Gardner, Thomas, Scholl and others and also added so excellent a series of 222 cases of his own that it is unnecessary for me to go into the details of previous experience and conclusions.

The majority of primary tumors of the bladder are of course the papillary fibroadenomata and the papillary villous cancers. Besides these squamous celled cancers with epidermization and cylindrical cell cancer are at times noted. Of other tumors fibromyomata sometimes with other connective tissue additions and large sometimes papillary nodular sarcomatous myomata of either smooth or striated muscles occur. Much rarer are the ordinary small round celled sarcomata, spindle cell sarcomata and very rarely lymphosarcomata and osteosarcomata.

In the histogenetic classification of the tumors according to the type of their parent soil a distinction is made in the first place between epithelial and non epithelial tumors. The latter are naturally derived from the deeper

layers of the vesical wall the muscular or the submucosa. Among the benign mature forms myomata, leiomyomata and fibromyomata are met with and pure fibromata may also occur. These tumors are usually small spherical and easily enucleated. They acquire a greater interest when the shape of their cells and often at the same time also the type of their growth undergo a change. In this manner large nodular fibrosarcomata, sarcomata and myosarcomata consisting of immature anaplastic cells may originate. Pure sarcomata are rare.

The tendency of the bladder to the formation of mixed tumors is shown by such malignant tumors being often mixed with various other tissue types. Genuine teratomatous mixed tumors have also been observed. There are osteoid chondrosarcomata, rhabdomyosarcomata sometimes with cartilaginous inclusions, adenofibrosarcomata and so forth. Furthermore there are angiomas, carcinomata and lymphangio endotheliomata.

The most important group of bladder tumors are the epithelial tumors. These are derived in part from the epithelial nests or from aberrant prostatic germs, adenofibromata and adenomata or they are developed from the surface epithelium. These tumors are the proliferations generally known under the name of papillomata and papillary carcinomata. In the interest of accurate nomenclature these tumors should be designated not as papillomata but as papillary epitheliomata or fibroepitheliomata and as papillary carcinomata for any tumor can be papillary including sarcoma whereas the decisive point for the designation is the histological composition of the tumors and this is fibro epithelial in character.

Probably a larger number of bladder cancers than supposed are extensions from the prostate. Kaufmann states that out of 27 prostatic cancers 18 had extended to the

bladder and with preference to the posterior wall. This has recently been brought quite forcibly to our attention in three operative cases and in two not operated upon. The growths in the bladder are commonly knob-shaped nodes and plates covered by relatively normal mucosa or with light loughing. They often resemble clinically a strawberry myoma and have slightly the appearance of the aged canned strawberry. Some surgeons believe that many so-called primary bladder tumors are in reality prostatic cancers. The fact that a prostatic cancer may occur in a grossly not enlarged prostate makes this not improbable even in cases in which the prostate is apparently grossly unchanged.

The epithelial tumors of the bladder are often divided into benign papillomata and malignant papillomata. Perhaps the commonest suggestive clinical signs of malignancy in these growths are

- 1 Induration
  - 2 Slough
  - 3 Resistance to fulguration
  - 4 Single tumor multiplicity very often means benign tumor
  - 5 Age of patient—older patients are more probably malignant
- Ceraghty classifies these tumors as

- 1 Papilloma
  - Benign
  - Malignant

Adenoma

Tumors of epithelial origin

Cysts

Carcinoma

Papillary

Squamous

Adenomatous

Tumors of connective tissue origin

Sarcoma

Myoma

Fibromyoma

Angioma

Tumors of muscular origin

Myoma

Heterotopic

Rhabdomyoma

Hydatid cysts

Dermoid cysts

Chondroma

Buerger divides them still farther into

- 1 Papilloma
- 2 Infiltrating papilloma
- 3 Papilloma with carcinomatous changes
- 4 Primary papillary carcinoma
  - a Papillary polypoid type
  - b Secondarily infiltrating type
- 5 Primary squamous celled carcinoma
  - a Infiltrating type from papilloma
  - b Squamous type from papillary tumors
  - c Secondarily prostatic tumor metastasis from without

In the main these classifications are the same. Personally I like the general plan of Christeller and divide these growths as follows

1 *Typical papillary fibro-epitheliomata (benign)* Their most important sign is that the epithelial proliferations remain restricted to the mucosa and is thus directed only toward the interior of the bladder. There is no tendency to grow into the deeper tissues and these tumors are therefore displaceable on their base.

2 *Atypical papillary fibro-epitheliomata (malignant)* These tumors although presenting certain histological irregularities in the pigment and basement membrane are without the most important signs of malignancy in the form of destructive growth. They penetrate nowhere into the submucosa or muscularis and do not give rise to metastases often reported as benign undergoing malignant change.

3 *Papillary carcinoma* These tumors are characterized by a destructive deep growth into the muscular layer. The superficially papillary structure closely resembling fibro-epithelium is deeply alveolar as in all other carcinomata. The histological diagnostic examination fully reveals the existence of typical cancer cell and destructive growth in the second and third stage so that the diagnosis of malignancy can be positively rendered the diagnosis of benignity in these cases affording information only of the segment of the tumor examined and not of the growth as a whole.

4 Aside from papillary cancers solid cancers also occur in the bladder being histo-



symptoms. If there was copious initial hæmaturia and was sought immediately. The cases of longer duration in many instances proved to be papillomata which had undergone malignant changes.

In the early stages carcinoma is a local disease. The rational treatment theoretically at least is complete and radical excision. In the bladder the disease often remains local for a long period and does not metastasize readily. Every effort therefore should be made to bring these patients for examination early that we may get rid of the local involvement before it becomes a general condition.

As a great many cases occur in the sixth, seventh and eighth decade the history and clinical picture are often combined and associated with signs and symptoms of prostatism. As many of these cases give a history of several years the age curve does not represent the true curve for the beginning of bladder tumors.

It would appear that the gastro intestinal manifestations of bladder tumors as compared with renal lesions are comparatively few.

Some patients complained of constipation and this was usually proved to be an anatomical effect. Symptoms of hypersecretion (gas eructations, hyperacidity and the like) are not the rule but it is interesting to note that in nitrogen retention due to conditions of and within the bladder the urea nitrogen may go to three to four times normal while the creatinine remains stable and fixed. The gastro intestinal symptoms in those instances are few.

Loss of weight and strength are marked only in the advanced cases while the blood pressure findings vary greatly being low frequently in the advanced carcinomata.

*Physical examination of the genito urinary tract.* The ordinary examination fails to disclose little that is diagnostic. Abdominal examination may be said to be negative. Occasionally there is suprapubic tenderness which is usually present when there is an associated acute cystitis.

Rectal examination in the case of papilloma of the bladder is practically always negative. In the case of carcinoma of the bladder the in-

filtration of the wall may cause the mass to be palpable while nodules in and about the prostate may be significant.

The urine findings are as one might expect. There is often macroscopic blood the specific gravity usually shows good variation the associated nephritis as evidenced by casts is not marked albumin is present from a slight trace to a considerable degree. Sugar was found in only one case in the series and this was a true glycosuria. Microscopical examination shows pus and red blood cells in varying degrees. In rare cases pieces of tissue were passed in the urine and were of diagnostic value.

*Kidney function (phthalein).* The phenol sulphonephthalein estimations are usually below normal but as in cases of the blood chemistry figures this condition improves following the establishment of free drainage.

Sufficient blood findings are not available to be of value but in several cases of carcinoma there was a slight leucocytosis. There is usually a varying secondary anemia.

In addition to these findings there may be the usual derangement of the various systems. In only one case was there a positive Wassermann.

*Cystoscopic examinations.* Findings at cystoscopic examination usually enable one to make a diagnosis. Occasionally a chronic inflammatory condition which has undergone degenerative or productive change or extensive bullous oedema will confuse or complicate the diagnosis.

Mortality includes death within 3 months of discharge. So-called cures were all followed for 6 months to 7 years mostly 1 to 3 years.

In the treatment of high frequency currents the bipolar method was used altogether the response in some papillomata to fulguration is very striking. I do not believe that high frequency is of any use in carcinomata except perhaps as a hæmostatic nor have I found it satisfactory in extensive tumors at the vesical neck mainly on account of difficulty of control in the area.

In cases of very extensive papillomatosis of the bladder the cautery through a suprapubic incision gives more satisfactory results. In removing these growths by the suprapubic

TREATMENT

TREATMENT	Case	Total
Papilloma of bladder malignant—39 cases		
Repeated fulguration		
Cured	12	
Improved	7	19
Cystotomy and cautery		
Cured	5	6
Improved	1	
Excision		
Cured	4	
Improved	2	6
Cautery and radium		
Cured	4	
Improved	1	5
Not treated	3	3
Carcinoma—78 cases		
Inoperable not treated		27
Excision		
Cured	7	
Recurrence	6	
Died	1	14
Excision and cautery		
Cured	2	
Improved	1	3
Excision and radium		
Cured	2	
Improved	2	4
Cautery and radium		
Cured	4	
Recurrence	1	
Died	1	6
Excision and transplantation of ureter cured		1
Excision and transplantation of ureter and radium, died		1
(This patient died from metastases 5 months later)		
Cystotomy and fulguration only palliative efforts advised cases		
Cured	1	
Recurrence	4	
Not improved	5	
Died	1	11
Deep X-ray inoperable cases		
Improved	2	
Not improved	3	
Died	1	6
Suprapubic drainage radiated inoperable condition		
Not improved	1	
Died	4	5

and perivesical coverings so that when the bladder is opened it is about two thirds out of the abdomen

Briefly the technique is as follows

The bladder is irrigated gently with warm boric or salt solution and the patient is put in the Trendelenburg position. A free median suprapubic incision is made to the bladder which is not opened at present. The peritoneal fold is carefully separated the urachus is liberated clamped cut and the upper stump ligated. The lower stump is used to draw the bladder toward the symphysis while the operator separates the peritoneum from the posterior wall of the bladder. The bladder is now well through the wound and the abdominal wound is well protected with gauze. The bladder is opened almost anywhere depending on the location of the growth or growths and with the electric cautery the tumors are destroyed *in situ* with as little manipulation and sparging as possible. If the case is one of benign papillomatosis complete destruction with cautery well into the bladder wall is sufficient. If however the cystoscopic and microscopic examination and the palpation at the operation suggests malignancy the underlying bladder wall must be widely excised. If the tumor involves a ureteral orifice it is best to excise the tumor and about 2 centimeters of ureter. The ureter is reanastomosed with the bladder by puncturing a healthy part of the bladder wall and drawing the ureter through for about 1 centimeter after splitting it into two lips and attaching it by catgut suture to the bladder.

The incision in the bladder wall and in extension cases the inside of the bladder is swabbed with carbolic acid and the wound and bladder are filled with alcohol for 3 minutes with the object of coagulating any viable tumor cells which may be about. The table is now returned to horizontal position. The wound is closed with a suprapubic tube to the bladder and an extravesical cigarette drain is placed along the operation incision in the bladder and through the suprapubic wound.

In the radium treatment emanation seeds were used and inserted through a hollow needle.

When deep X-ray treatments were given they consisted of a series of 4 treatments of

route the operator must remember the property of epithelial cells to grow on denuded surfaces. Therefore we must develop a method which prevents implants we must destroy the tumor *in situ* sponge as little as possible and protect the perivesical space and the wound in the abdominal wall so that no accidental implants may result.

In the surgical technique for the removal of bladder tumors we have used for a number of years the method of approach favored by Beer Squier and others namely the extraperitoneal liberation of the bladder permitting the drawing of the organ well out of its peritoneal





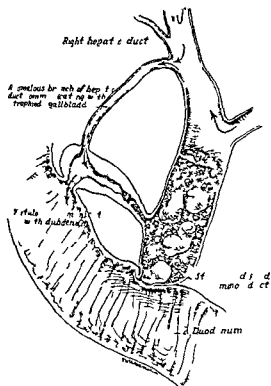


Fig. 1. A large abnormal hepatic duct and a cholecystoduodenal fistula providing the only pathway for the escape of bile into the intestinal canal. This duct was discovered during an operation.

in the belching of gas. In the 4 months preceding admission there had been frequent periods of severe headache with the ever present epigastric discomfort but no evident jaundice. On admission several days following another acute attack of exceedingly severe pain which had again been ushered in by a chill there was no jaundice and only slight residual tenderness in the epigastrium.

Fluoroscopic and roentgenological studies revealed a small defect in the pylorus which was concave in appearance, a moderate gastric residue with a small duodenal cap that was constantly irregular. These findings were interpreted as indicating an indurated lesion at the pylorus which was either an ulcer or early carcinoma.

However on the basis of a clinical diagnosis of gall stones an operation was performed and the following picture was disclosed which could be easily correlated with the above clinical history (Fig. 1). Dense fibrous adhesions between the anterior abdominal wall and the liver surface prevented the usual downward displacement of the liver. The duodenum and omentum were also firmly adherent to the under surface of the liver. Freeing these adhesions revealed a greatly contracted gall bladder about

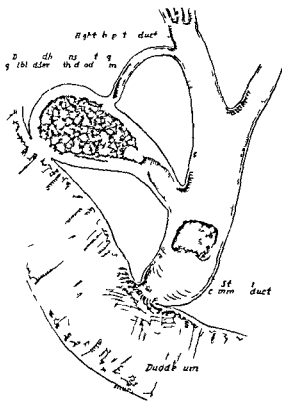


Fig. 2. Dense fibrous adhesions between gallbladder and duodenum and an anomalous hepatic duct suggest a process similar to that pictured in Figure 1 either uncompleted or healed.

the size of the end of the thumb. In attempting to free this from the duodenum bile suddenly escaped through an opening which proved to be a fistulous communication between the gall bladder and the duodenum. The dissection was continued a cystic duct about 4 millimeters in diameter was isolated and a greatly enlarged common duct 1.8 centimeters in diameter was disclosed. In dissecting free the gall bladder from the under surface of the liver a small duct 2 millimeters in diameter was disclosed which proved to be an abnormal communication between the gall bladder and the hepatic ducts. Bile leaked from the cut hepatic end necessitating ligation of this abnormal duct. The other cut end opened directly into the small contracted gall bladder. The common duct was opened and found to be compactly filled with irregularly formed gall stones and a large amount of mud and sand. It was evident that no bile had flowed through the usual route but that it must have passed through the circuitous path indicated in Figure 1. The common duct was thoroughly evacuated and drained through the cystic duct by means of a No. 12 catheter the longitudinal opening in the duct being completely closed with fine silk. The fistulous opening into the duodenum was closed

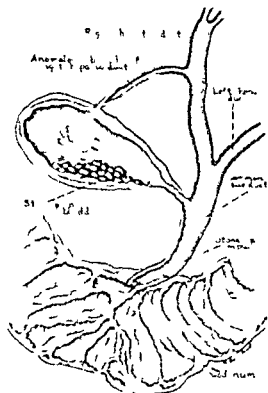


Fig. 3. Anomalous position of the gallbladder wall which may result from torsion.

and covered with omentum. Two cigarette drains were placed in the lumen of the Winkler. The patient made an uneventful recovery.

CASE 2. Figure 2. M. T., a woman of 60 years of age, with a history of gallbladder disease with increasingly severe attacks of pain, lasting over a period of 50 years. At the age of 18 she was troubled with epigastric discomfort attributed to indigestion, which later appeared in intervals of 3 to 4 months and was relieved by vomiting and belching of gas. This discomfort finally gave place to attacks of pain of increasing frequency and severity until she became almost intolerant in the intervals and daily recurrence. In the course of 40 years of these attacks she became irritable. The first jaundice appeared 2 years before the operation, accompanied by chills and fever. The jaundice has recurred at frequent intervals, but quite as quickly disappears.

At operation the following picture was found (Fig. 2). The duodenum was very adherent to the fundus of the gallbladder as was the omentum. In freeing the duodenum the gallbladder was opened and although no opening into the duodenum was demonstrable, the dense fibrous deposits in the at-

terial biliary canal communicated with the gallbladder wall. In the duodenum was a large gallstone. The gallbladder was with its cystic duct in the under surface of the liver where the retractor muscle fibers are attached. In the liver on an anastomosing duct at 3 cm. in length in the liver was a dilated duct with the escape of bile. This duct which required ligation entered the liver substance, but its distal end was lost in the fibrous wall of the gallbladder. Its communication with the gallbladder at the point of attachment there had occurred at some time in the course of the disease. The structure of the gallbladder wall with evidence of liver substance at the distal end of a fistulous communication between the liver and the gallbladder with subsequent cholecystitis. A hugely dilated common duct was dissected fully 2 centimeters in diameter. It contained a large stone which was removed through a longitudinal opening. The perineum was closed with interrupted sutures, and the common duct drained by means of a No. 14 catheter introduced through the cystic duct. The patient made an uncomplicated recovery and left the hospital on the twentieth day following operation.

CASE 3. Figure 3. B. K., a Russian Jewess, 43 years old, who was admitted to Lakeside Hospital November 8, 1924, had been operated upon 1903 for previously for gallbladder disease. She had several attacks of severe right upper quadrant pain. She remained well for 4 years when she began having similar attacks of pain, although not so severe nor as prolonged. During the past 6 months the pain has increased in severity and frequency and in the last 8 weeks has been accompanied by a variable fluctuating jaundice and vomiting. On admission there were icteric tenderness and spasm of the muscles of the right abdomen and repeated vomiting. She was peritonitic, anasarca, and the following observations were made. The liver and gallbladder were enlarged, the latter under the surface of the old wound in the right upper quadrant. The separation of the gallbladder from the under surface of the liver was effected with considerable difficulty due to the fibrous strands. In the course of the dissection a relatively large duct full of millimeter sized stones was found, the escape of clear bile while this duct could be easily followed on the surface of the liver for 2 centimeters when it disappeared in the perineum of the right lobe. The lumen was tapered. The other part of the common duct was found in the thickened fibrous wall of the gallbladder. The cystic duct was then found empty, the common duct in the lumen. The common duct was somewhat dilated to about 2 centimeters in diameter. The gallbladder was removed for dilatation of the common duct in the fundus and to contain the numerous small irregularly formed stones and consider the common duct of the gallbladder was moved from the anastomosis to the duodenum with dilated until it



rapid absorption of catgut or to excessive trauma? We do not know but in the face of our experimental evidence the double ligature has been avoided and the following simple procedure adopted

The duct is carefully ligated with a single strand of medium black silk. A French needle threaded on one end of this same ligature which is then transfixed in place by passing the needle through the stump of the cystic duct at a point immediately beyond the location of the ligature. The threads are again tied. The needle is never introduced proximal to the ligature since bile leakage around the stitch holes may occur. An attempt is made in each instance to cover this ligature with folds of peritoneum in order that the drain may not lie directly against the open end of the stump or the ligature. No bile drainage or postoperative complication which could be directly attributed to cystic duct leakage has been encountered since the adoption of this procedure.

In the experiments on cystic duct ligation an interesting observation was made on the healing that occurs following application of the ligature. Several years ago Dr Halsted called attention to the healing process that follows ligation of an artery.<sup>1</sup> The infolded and snugly opposed intimal surfaces under the compressing band have in no instance adhered to each other and for the reason that the pressure necessary to produce even a very slight reduction in the lumen of the vessel has in my experience invariably caused atrophy of its wall. When the occlusion is complete the necrotic arterial wall included in the metal band becomes replaced by a solid cylindrical

cord of fibrous tissue the substitution taking place from the ends.

A similar process apparently occurs within the ligature closing the cystic duct (Fig. 4). There is necrosis of the included duct wall with fibrous tissue substitution but it is evident from our experiments that this fibrous tissue may subsequently be absorbed so that the ligature becomes entirely freed and is found lying on the surface of the liver covered only by peritoneum. This was repeatedly noted in the older specimens for example in one of 134 days duration and in another of 147 days duration. This freeing of the ligature is quite comparable to the extrusion of silk ligatures in intestinal suture and in the healing of abdominal wounds.<sup>2</sup>

# SUMMARY

Anomalous branches of the hepatic duct may be responsible for slight or moderate postoperative bile drainage which is unexplained by a reopened cystic duct. The danger of bile leakage from divided but unidentified ducts suggests that drainage is a necessity even in simple cholecystectomy.

Double ligation of the cystic duct is contraindicated by the possibility of cyst formation between the ligatures followed in the presence of infected bile by a localized abscess.

The healing that occurs in a ligated cystic duct is comparable to the healing of a ligated artery. Necrosis of the duct wall occurs with fibrous tissue substitution. This fibrous tissue is later reabsorbed and the ligature freed unless of course an absorbable suture has been employed. No ill effects attributable to the use of silk have been encountered.

W. S. H. J. d. D. I. no. I. h. g. d. I. p. l. y. R. h. e. r. d. I. l. i. n. a. T. h. f. t. f. h. r. e. b. e. d. i. n. o. c. i. d. b. a. b. l. \. A. c. c. i. S. i. H. o. p. H. l. s. m. o. n. d. h. h. b. o. o. f. w. e. d. s. j. o. b. I. l. p. l. a. n.

THE CANCER CELL AND NATURE'S DEFENSIVE MECHANISM<sup>1</sup>

By WILLIAM CARPENTER MACCARTY, M.D. ROCHESTER, MINNESOTA

THE human body is an organism composed of groups of cells of at least forty five different types all of which have evolved from a fertilized human ovum (Fig. 1). In this evolution fertilization, segmentation, differentiation<sup>2</sup> and specialization occur. Tissue differentiation in the human body occurs in such a manner that it may be divided into three recognizable stages (Fig. 2): first the establishment of the general alignment of the cells which is seen in the normal arrangement of adult tissue—the cells themselves remaining undifferentiated; second the establishment of cellular polarity such as is seen in fully differentiated tissue; and third the establishment of adult morphology of the cell. In the condition of no differentiation and the first and second stages just described the cells bear no morphological resemblance to their adult forms.

During differentiation and specialization nature provides for the two natural phenomena of destruction and regeneration: one a cause and the other an effect. The biological phenomenon of destruction of any tissue may be caused by many things and conditions; the specific causes of destruction vary. Regeneration of adult tissues occurs in two ways in the human body: directly (regeneration of adult cell from adult cell) and indirectly (regeneration from reserve cells). The malignant cell or the cell which has been called a cancer cell in which we are clinically especially interested is evolved from a reserve cell although it may be derived directly from a cell which is normally regenerated directly. The study of the malignant cell, its behavior and the natural defensive reactions of the organism to its abnormal proliferation and invasion to its rest of the body constitute a problem of greatest practical economic importance. Accurate knowledge of the cell's origin, the condition which promote its proliferation, its attempts at differentiation, its invasive

qualities and the body's method of preventing further destruction will provide us with a means of preventing cancer—a service far greater than curing it. Any means of early recognition which will allow early removal—the only known method of cure—is well worth our intense consideration.

It should be worth something even to those who correctly or incorrectly hold the parasitic theory of etiology of cancer to know just what cells are affected by parasites. It may also be of value in impressing upon the medical profession as well as the specific cancer investigators that the etiology of cancer is something which probably involves many factors besides parasites. In all probability there is what might be called an essential pathology (a physicochemical condition) necessary before parasites invade and give gross clinical entity to all known parasitic diseases.

Perhaps the simplest way to convey the facts to the medical profession as they have been seen in the biological and cytological study of neoplasms is for us to confine our attention to principles in one organ. In Figure 3 one sees diagrammatically illustrated the evolution of the milk-producing cell of the mammary gland. From the ectoblastic layer of the three-layer stage of development of the embryo the cells of the stratum germinativum of the fetal skin arise from them by differentiation arise the fetal squamous cells. Also from them by multiplication down growth into the subepithelial tissues and differentiation the lining cells of the mammary tubules and acini arise. It may be seen that there are two layers of cells in each normal mammary acinus. The cell lying adjacent to the lumen is secretory (adenocytes) and the cell lying next to the stroma are the reserve cell (adenoblasts). In chronic mastitis some one or more unknown thing or conditions destroy the secretory cells; the reserve cell become hypertrophic or enlarged. This is a common picture in chronic mastitis with or without the presence of cancer. In some chronic mas-

<sup>1</sup> Addressed at the 10th Annual Meeting of the American Society of Cancer Research, held at the University of Chicago, Chicago, Ill., May 1-4, 1924.

<sup>2</sup> Read before the 17th Annual Congress of the American



acini in some chronic mastitides in which this proliferative condition exists one finds the line of demarcation between acinus and stroma destroyed by the migration of undifferentiated cells. The last picture is the one we call cancer the cells are of the type seen in Figures 4 and 5

The question arises Has the malignant cell a morphology by which it may be recognized? Text books describe the cancer cell as having an irregular shape with an irregularly shaped nucleus which takes the stains densely and frequently shows an asymmetrical mitotic figure. This description applies to those cells in pathological tissues which have been dead for some time—have undergone cytological changes coincident to and following death—and have been fixed in strong solutions and then embedded in celloidin or paraffin. It is not the picture which one sees in living tissues or tissues which although dead have just died and are studied in an unfixed condition with oil lenses. Under these less destructive conditions the cancer cell is an ovoidal or spheroidal body with no irregularities of cell wall nucleus or nucleolus the demarcations of the component parts of the cell are perfectly sharp and distinct the granules of the cytoplasm and nucleoplasm are fairly uniform in size the mitotic figures are sometimes multipolar but they are not asymmetrical and irregular in my experience. The whole cell when studied in the fresh condition is the object of study it is not cut in planes. Its constituents are not coagulated and are therefore transparent or translucent there is no necessity for thin sections such as one attempts to obtain with celloidin and paraffin methods.

Many pathologists have said that it is impossible and unsafe to diagnose cancer from single cells they prefer low power histological studies. For pathologists who have not made a detailed high power study of the forty five adult cells the characteristics of cells in normal regenerative stages do not understand the details of cellular differentiation and have not studied living and fresh malignant cells with the oil lenses the diagnosis must be impossible and unsafe.

The cancer cell may not always be distinguished from a normal regenerating cell but



0° Differentiation



1° Differentiation



2° Differentiation



3° Differentiation

1. Diagrammatic representation of the changes in the differentiation of a glandular unit during normal embryonic development. It also represents the stages of differentiation in neoplastic conditions.

this can be done frequently because there is a difference in volume relationship between nucleolus nucleus and the whole cell in the reparative regenerative cells and malignant regenerative cells. There is also a difference in the density of the nucleoplasm and cytoplasm in the extreme exemplars of these two cells. The regenerative cell is more delicately constructed (Figure 6) and its nuclear granules are usually finer the nucleoli are smaller in proportion to the size of the nucleus and the whole cell. These are some of the differential points. There are qualities which words cannot describe. One learns to recognize the types of cells from experience with actual clinical proof of diagnosis and prognosis just as one recognizes members of his family and friends. It is not always possible to describe our friends in such a manner that others can recognize them. Expertness in the differential recognition of malignant cells reparative regenerative cells and adult cells comes through constant contact with them checked



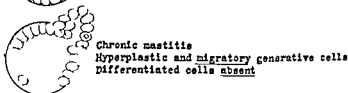
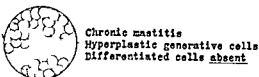
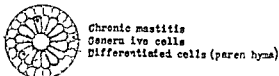
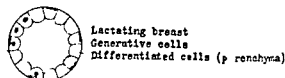
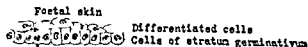
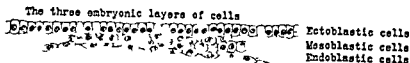


Fig 3 Diagrammatic representation of the life of a mammary gland type of ill (den blot and all cells) The gland has the three changes in the life of the gland. The hyperplastic and migratory generative cells are the cause of the malignant growth.

by clinical proof of diagnosis. The problem is one of cytology, not histology. The malignant cells which have just been described are malignant because they invade the surrounding tissues, spread to distant parts of the body where they multiply independently, disturb the vitality of the whole organism directly and indirectly, and eventually cause death.

The body provides for a certain amount of protection against malignant invasion by

causing hosts of lymphocytes to migrate to the field of action (Figure 7 a b) and to surround the area which is filled with malignant cell. It also builds a fibrous connective tissue barrier (Figure 7 c d) around them and sometime increases the density of this by hyalinization (Figure 7 e f). There is great variability in the occurrence of these reactions in different individuals and in different organs of the body, there is probably some



FIG. 4. Photomicrographs of malignant cells in the (a) blood, (b) bone, (c) but, (d) embedded state, (e) and (f) showing the postoperative changes in the lymphatic system.

variation at different times in the same body. Thus one does not always find them present or finds them in different degrees of intensity. The following table shows the frequency of the defensive factors in the organs which have been studied.

	S. m. h. p. case	B. t. ses	R. m. case	k. ses
Frequency of diff. t. t. n.	6	86	86	65.5
Frequency of lymphocyt. filtrat. n.	9	60	57	65.5
Frequency of fibrosis		68	75	41.3
Frequency of hyaline		5		3
Frequency of diff. nt at				
Frequency of lymphocyt. c. i. flt.				
Frequency of diff. nt at		6	50	37.9
Frequency of diff. nt at		7	7	7
Frequency of lymphocyt. filtrat. n.		4		7
Frequency of lymphocyt. filtrat. n.		40	47	4
Frequency of lymphocyt. filtrat. n.				6
Frequency of lymphocyt. filtrat. n.		5		7.5

Whether differentiation is a defensive factor or a cellular reaction to lymphocytic infiltration, fibrosis and hyalinization remains yet to be shown. Theoretically—as in normal differentiation—it is the result of a favorable environment. Regardless of its cause there are certain clinical facts which are significant. Thus we see in the following figures that there is a greater average length of postoperative life when differentiation is present.

	S. m. h. p. case	B. t. ses	R. m. case	Sk. d. ys.
Average length of postoperative life with differentiation	2.73	3.65	54	534
Average length of postoperative life without differentiation	6	37	68	74.7

In this series all patients were known to be dead from recurrence of their lesion or metastases. Since these observations were made Dr. Broders has studied a series of epithelio-

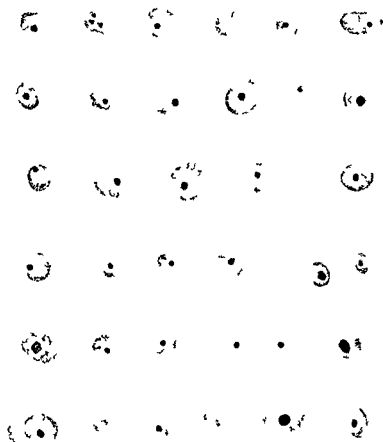


Fig. 5. Skeletal cells from myeloid leukemia. The picture shows the differentiation of myeloid leukemia cells into various stages of development. The cells are arranged in a grid, showing the progression from undifferentiated cells to more differentiated forms, including cells with prominent nuclei and cytoplasmic structures.

matrix with interesting results which also emphasize the value of differentiation as one of the factors to be taken into consideration in studying prognosis. In his series he considered all cases whether dead or alive. He graded his microscopic sections in the following manner: When three fourths of the cells were differentiated and one fourth not differentiated the condition was graded I; when one half of the cells were differentiated and one half undifferentiated it was graded II; when one fourth of the cells were differentiated and three fourths undifferentiated it was graded III; and when there was no differentiation it was graded IV.



a b  
The figure shows two examples of cells from myeloid leukemia. (a) shows a cell with a large, dark nucleus and some cytoplasmic detail. (b) shows a cell with a more complex, multi-lobed structure, possibly representing a more advanced stage of differentiation.



Fig 7 R t i o s e n t m a l i g n a t n e p l t d t o b l y m p h o v t f i l t t d t b o a n d l y m p h o c y t i c f i l t t e f h y a l i n t

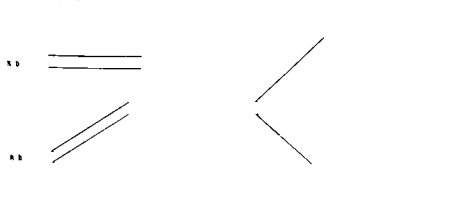


Fig 8

Fig 8 Th lat f th r t f hyp rpl (RIL) t  
th rat f d f e t t (RD) Th t h r i z t i p l l l  
l n b a d d p t t h l t s h p t h r m l  
p o c f t p Th l f g u p t  
n c n t h t f h y p r p l d t h r a t e f d i f f t  
t i o n t h s o c l l e d b g p l m a t Th  
g t h b u t t h l l h d l t m r p h l g y  
Fig 9 G a p h i c p t t i f a d t n  
i n t h s c n d r p f e o p l m t a t h r a t f h y p e

Fig 9

pl a s s c e a d n d t h e a t e f d i f f t t i s l a t i  
l y d c e a e d T h e c l l f u c h n e p l a m t a h a n t  
d l t m r p h o l g y l t h g h t h y m a y a p p c h d u l t  
g e m n t o f c l l  
Fig 9 G a p h i c p t t i o f a t h l g o u p f  
p l m a t a w h h t h r a t f h y p e r p l a s i c a d  
d t h r a t e f d i f f t t r e d e d t r l t h  
c d t i n t h s o r e m b l n c t n y d l t t u e n  
l l l t m r p h l g y r a g e m t

Fig 1

# OPERATIVE RESULTS IN EPITHELIOMA IN RELATION TO CELLULAR DIFFERENTIATION

## TABLE I. Results

Grade	Cellular Differentiation	No. of Cases	No. of Deaths	No. of Survivors	No. of Cured Cases
Grade I (I)	Differentiated	31	3	28	28
Grade II (II)	Differentiated	42	10	32	32
Grade III (III)	Differentiated	66	31	35	35
Grade IV (IV)	Not Differentiated	100	100	0	0

## TABLE II. Results

Grade	Cellular Differentiation	No. of Cases	No. of Deaths	No. of Survivors	No. of Cured Cases
Grade I (I)	Differentiated	8	1	7	7
Grade II (II)	Differentiated	49	14	35	35
Grade III (III)	Differentiated	5	0	5	5
Grade IV (IV)	Not Differentiated	100	100	0	0

## TABLE III. Results

Grade	Cellular Differentiation	No. of Cases	No. of Deaths	No. of Survivors	No. of Cured Cases
Grade I (I)	Differentiated	1	0	1	1
Grade II (II)	Differentiated	45	15	30	30
Grade III (III)	Differentiated	1	0	1	1
Grade IV (IV)	Not Differentiated	1	1	0	0

It may be seen that the live percentage of deaths was in Grade I (three fourths differentiation) and the highest percentage in Grade IV (no differentiation). A similar relation may be seen in his study of the good and poor results in these patients. The live percentage of good result occurred in Grade I (three fourths differentiation) and the highest percentage of poor results in Grade IV (no differentiation). The effects in conjunction with those which had been previously observed in the stomach, breast and rectum seem very significant.

The study of lymphatic reaction, fibrin and hyalinization all present interesting facts.

Grade	Cellular Differentiation	No. of Cases	No. of Deaths	No. of Survivors	No. of Cured Cases
Grade I (I)	Differentiated	1	0	1	1
Grade II (II)	Differentiated	45	15	30	30
Grade III (III)	Differentiated	1	0	1	1
Grade IV (IV)	Not Differentiated	1	1	0	0

With an idea of studying which of these factors or combinations of factors was most important the following observations were made:

Grade	Cellular Differentiation	No. of Cases	No. of Deaths	No. of Survivors	No. of Cured Cases
Grade I (I)	Differentiated	1	0	1	1
Grade II (II)	Differentiated	45	15	30	30
Grade III (III)	Differentiated	1	0	1	1
Grade IV (IV)	Not Differentiated	1	1	0	0

If the difference between the length of post operative life with the individual factors and without them is not sufficiently great to warrant definite conclusion, certainly the figure computed with all of the factors present

REPORT OF NEOPLASMATA									
Case No.	Site	Sex	Age	Time of onset	Plasma	Time	Site	Time	Site
1	Colon	M	55	1945	Adenocarcinoma	1945	Colon	1945	Colon
2	Stomach	F	45	1945	Adenocarcinoma	1945	Stomach	1945	Stomach
3	Esophagus	M	60	1945	Adenocarcinoma	1945	Esophagus	1945	Esophagus
4	Lung	M	50	1945	Adenocarcinoma	1945	Lung	1945	Lung
5	Pancreas	F	55	1945	Adenocarcinoma	1945	Pancreas	1945	Pancreas
6	Bladder	M	65	1945	Adenocarcinoma	1945	Bladder	1945	Bladder
7	Prostate	M	70	1945	Adenocarcinoma	1945	Prostate	1945	Prostate
8	Uterus	F	50	1945	Adenocarcinoma	1945	Uterus	1945	Uterus
9	Vagina	F	45	1945	Adenocarcinoma	1945	Vagina	1945	Vagina
10	Cervix	F	40	1945	Adenocarcinoma	1945	Cervix	1945	Cervix
11	Rectum	M	55	1945	Adenocarcinoma	1945	Rectum	1945	Rectum
12	Sigmoid	M	50	1945	Adenocarcinoma	1945	Sigmoid	1945	Sigmoid
13	Small Intestine	M	45	1945	Adenocarcinoma	1945	Small Intestine	1945	Small Intestine
14	Large Intestine	M	55	1945	Adenocarcinoma	1945	Large Intestine	1945	Large Intestine
15	Stomach	F	45	1945	Adenocarcinoma	1945	Stomach	1945	Stomach
16	Esophagus	M	60	1945	Adenocarcinoma	1945	Esophagus	1945	Esophagus
17	Lung	M	50	1945	Adenocarcinoma	1945	Lung	1945	Lung
18	Pancreas	F	55	1945	Adenocarcinoma	1945	Pancreas	1945	Pancreas
19	Bladder	M	65	1945	Adenocarcinoma	1945	Bladder	1945	Bladder
20	Prostate	M	70	1945	Adenocarcinoma	1945	Prostate	1945	Prostate
21	Uterus	F	50	1945	Adenocarcinoma	1945	Uterus	1945	Uterus
22	Vagina	F	45	1945	Adenocarcinoma	1945	Vagina	1945	Vagina
23	Cervix	F	40	1945	Adenocarcinoma	1945	Cervix	1945	Cervix
24	Rectum	M	55	1945	Adenocarcinoma	1945	Rectum	1945	Rectum
25	Sigmoid	M	50	1945	Adenocarcinoma	1945	Sigmoid	1945	Sigmoid
26	Small Intestine	M	45	1945	Adenocarcinoma	1945	Small Intestine	1945	Small Intestine
27	Large Intestine	M	55	1945	Adenocarcinoma	1945	Large Intestine	1945	Large Intestine
28	Stomach	F	45	1945	Adenocarcinoma	1945	Stomach	1945	Stomach
29	Esophagus	M	60	1945	Adenocarcinoma	1945	Esophagus	1945	Esophagus
30	Lung	M	50	1945	Adenocarcinoma	1945	Lung	1945	Lung
31	Pancreas	F	55	1945	Adenocarcinoma	1945	Pancreas	1945	Pancreas
32	Bladder	M	65	1945	Adenocarcinoma	1945	Bladder	1945	Bladder
33	Prostate	M	70	1945	Adenocarcinoma	1945	Prostate	1945	Prostate
34	Uterus	F	50	1945	Adenocarcinoma	1945	Uterus	1945	Uterus
35	Vagina	F	45	1945	Adenocarcinoma	1945	Vagina	1945	Vagina
36	Cervix	F	40	1945	Adenocarcinoma	1945	Cervix	1945	Cervix
37	Rectum	M	55	1945	Adenocarcinoma	1945	Rectum	1945	Rectum
38	Sigmoid	M	50	1945	Adenocarcinoma	1945	Sigmoid	1945	Sigmoid
39	Small Intestine	M	45	1945	Adenocarcinoma	1945	Small Intestine	1945	Small Intestine
40	Large Intestine	M	55	1945	Adenocarcinoma	1945	Large Intestine	1945	Large Intestine

checked against their complete absence may be significant

At a level of 10% with lymphocytic infiltration of the tumor, the average length of postoperative survival with lymphocytic infiltration of the tumor was 4.4 years. At a level of 20% with lymphocytic infiltration of the tumor, the average length of postoperative survival with lymphocytic infiltration of the tumor was 5.0 years.

Interesting and important as these facts are we must not forget that there are probably other conditions which influence longevity. One must not ignore age, lymphatic involvement, multiplicity of lesions, proximity to vital structures, duration of lesion, size of lesion, and general condition of the patient. With due consideration for these plus the facts relative to lymphocytic infiltration, fibrosis, hyalinization, and differentiation one may very accurately prognosticate in the majority of instances.

The correlation of the presence and degree of differentiation with longevity in patients with neoplasms is very significant in giving us a

basis for grouping neoplasms and recognizing clinical values in each group. *Malignancy is dependent upon a relationship between the rate of hyperplasia and the rate of differentiation.* Thus in normal tissue repair the rate of differentiation goes hand in hand with the rate of hyperplasia, a phenomenon which may be diagrammatically represented by two parallel horizontal lines (Figure 8). One finds, however, conditions in which the rate of hyperplasia is increased and the rate of differentiation is likewise increased. Such an overgrowth is composed of cells which have adult morphology such as one sees in moles, warts, fibromata, true adenomata, etc. This represents a definite group of neoplasms regardless of what name we give them (Figure 8). One sees a second group in which there is an overgrowth of cells which although arranged in the form of adult normal tissues are still undifferentiated or partially differentiated. The rate of hyperplasia is increased and the rate of differentiation is relatively decreased (Figure 9). Since it is well known in nature that growth is indirectly proportional to the height of differentiation one would naturally suspect that this second group of tumors would grow more rapidly than the first. This group embraces such neoplasms as adenocarcinoma, fibro-osteosarcoma, epitheli-

From the data in the above table, it can be seen that the correlation of the presence and degree of differentiation with longevity in patients with neoplasms is very significant in giving us a



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## BONE FORMATION IN THE THYROID GLAND

By M. C. SELLIC, M.D., F.A.C.S., St. Louis

**T**HE following case history of extensive bone formation in the thyroid gland merits recording from several points of view. In the first place massive bone formation in the thyroid, so called *struma osses*, is not commonly encountered in the second place complete block of the sympathetic trunk in the neck due to pressure by thyroid enlargement is a very unusual phenomenon and finally the case history calls into question the problem of calcification and ossification.

M. W., a male patient 52 years old entered the hospital October 17, 1923 complaining of general sickness, inability to continue his work as a laborer, lack of power of concentration and a loss of about 20 pounds in weight during the past year. His family and past history were both strikingly negative.

His illness dated from a year ago when he noticed that after a few hours of work objects became dim and he could not read the blue prints on his desk. This was followed by dizziness and weakness but after resting a while he could resume his work. He stopped working for 2 days and then began again and remained perfectly well for 2 months. The symptoms then set in again accompanied by pain in the head. This headache was dull in character, localized about the frontal region but never assuming the nature of an acute headache. These attacks of dizziness and sickness were repeated about once a month growing slowly more severe with a tendency to be accompanied by somnolence. The dizziness is of short duration but if the patient happens to be standing at the time he stumbles and has a tendency to fall. During these periods his arms and legs get weak. He finally quit work on September 15 on account of dizziness, weakness and pain in the head. Prior to fracture he had been a carrier by glass a year and a half before the onset of the present illness. There is no history of impairment of hearing, taste or smell.

The patient a well developed man of 3 years of age showed clearly that he had lost weight. Facial expression was placid in the absence of pain at the time of examination. Skin and mucous membranes are fairly normal in color. Growth and distribution of hair are normal. The ears are grossly negative. There is no impairment of hearing, no mastoid tenderness. The nose is negative there is no nasal obstruction, no sinus tenderness. The eyes show no phthalmos with hypotropia of the left globe. The left palpebral fissure is slightly but definitely narrower than right. The sclerae are clear. The left

pupil is much smaller than the right. The pupils are regular in outline and react promptly to light but sluggishly to distance. External ocular movements are normal. The media are clear in both eyes and the disks are normal. The maculae and peripheries are normal. The vessels are normal in contour and outline. Refraction in both eyes +1. The mouth shows mucous membrane of good color, teeth worn, tongue clean, slightly tremulous and not deviating on protrusion. The pharynx is negative. The tonsils are negative. The neck shows no indication of fullness at the base extending to both sides of the midline particularly prominent on the left side. Carotid pulsation is visible. The anterior chain of lymph nodes are enlarged on the left side with a few enlarged nodes on the right side. The fullness at the base of the neck is clearly an enlarged thyroid which is larger on the left where it dips under the sternocleidomastoid muscle. The tumor moves on deglutition as sometimes irregular in outline on palpation (anatomata) and has the consistency of ordinary hypertrophic thyroid tissue. Range of neck movements is normal and no pain or tenderness is present on palpation. There is no tracheal tug. The heart is of the narrow type but symmetrical. The back is straight, good range of movements, no muscle spasm. Several nerves are scattered over the chest. There is a normal apex beat in the fifth interpace. All other signs referable to heart and lungs are normal. The abdomen is negative in all respects. The extremities are negative. The blood pressure is 120/78. Larynx examination shows the left cord wider than right with a tendency to lag a bit. The nervous system shows no signs of abnormality except those symptoms already noted as referable to a compromised cervical sympathetic. X-ray examination negative. There was no evidence of intrathoracic goiter and the first examination of the plates failed to show any shadow cast by the thyroid. After operation had disclosed bone in the gland the X-ray plates were reexamined and it was found that we had overlooked a shadow cast by the gland due to the fact that this shadow had superimposed upon it the shadow of the left clavicle. Blood urinalysis, Wassermann reaction, uric acid were all negative.

**Operation.** Under general ether anesthesia a typical hemithyroidectomy was done without difficulty of any kind. The removed lobe was 6.5 centimeters wide, 5 centimeters long and 4 centimeters thick. During the procedure the following observations were made: The anterior portion was made up of typical anastomosing thyroid tissue fairly soft in consistency and the ductular surface and that the posterior portion of the lobe was stony hard and bony. After the removal of the



Fig. 1. Semid grammatic drawing of field of operation showing the ossified portion of the thyroid growing behind the carotid and pressing upon the sympathetic.

low it was readily seen that the hard ulster was really a mass of bone triangular in outline and that it had crowded the carotid artery somewhat externally growing under the vessel and pressing with its sharp bony edge against the cervical sympathetic nerve. No visible break in the continuity of the cervical sympathetic nerve could be made out. Figure 2 is a semi-grammatic representation of the field of operation. Figure 3 is a photograph of the anterior surface of the removed lobe. Figure 4 is a roentgenogram of the removed lobe taken in the anteroposterior direction showing



Fig. 3. Roentgenogram of the removed lobe in the anteroposterior position.



Fig. 4. Photograph of the specimen from the

bone distribution in this plane. Figure 5 is also a roentgenogram taken in the lateral plane and showing the bone distribution in this plane. This latter figure shows very well that almost the entire posterior portion of the gland is made up of bone.

A microscopic examination showed that the anterior portion of the lobe was made up of simple normal thyroid tissue and that the posterior portion was made up of primitive new bone. Figure 6 is a photomicrograph of 5 diameters magnification showing a heavy bone septum with a thyroid lobule on each side of it. Figure 6 is a higher magnification (10 diameters) of the bone formation showing a primitive haversian canal.

**Postoperative course.** The patient made an unusual smooth recovery, rested for a few weeks after operation and then returned to his work. In the course of a couple of months he was at hard labor in excellent health and had regained all the weight that he had lost. The enophthalmos myosis was hypotonia of the globe and ptosis had not improved when the patient was last seen several weeks after operation.

**Recapitulation.** Here then we have the history of a definitely compressing asthma running hand in hand with a disabling vertigo, a pronounced Horner's syndrome (enophthalmos myosis hypo-



Fig. 5. Roentgenogram of the removed lobe in the lateral plane showing the bone deposition in the posterior portion of the lobe.



Fig. 1. Enlarged thyroid gland (5).  
T. Thyroid gland.

in an individual who had a marked increase in weight and strength. In spite of the fact that the symptom complex strongly suggested either a malignant tumor of the thyroid or a carcinoma of the thyroid, nothing could be made out on physical examination or roentgen-ray examination. The operation and the histological examination confirmed the diagnosis of a carcinoma of the thyroid. The tumor was a well-circumscribed, firm, white, nodular mass, the size of a walnut, with a sharp edge of the tumor. The tumor was found in the lower part of the thyroid gland, but there is no satisfactory explanation of the marked improvement in health, strength, and weight following an operation that a few days later only in the removal of a simple adenoma of the thyroid gland.

A survey of the literature of the thyroid emphasizes the rarity with which ossification occurs. One author (Schriber (5)) says that the ossification is quite common and that of 5 cases of gland operated upon in the course of 3 months 5 showed ossification with demonstrable osteoblasts and marrow. Hunziker and Butler (2) make a similar statement. These are the only statements of the kind that I have been able to find. Opposed to them is the fact that Ziegler (10) in his text book of pathology says that ossification of the thyroid (*struma ossosa*) is very rarely encountered. Furthermore I have been able to find only one report and that a very meager one by Willis Meyer (5) describing ossification of the thyroid. Kennell (7) described a solid tumor of the thyroid of stony hardness causing vocal cord paralysis.

These two cases are the only ones in the literature which have been reported. The first case was reported by Willis Meyer (5) in 1901. The second case was reported by Kennell (7) in 1902. The first case was a woman, 45 years of age, who had a large, hard, nodular tumor of the thyroid gland. The tumor was removed and the histological examination showed ossification of the thyroid gland. The second case was a man, 45 years of age, who had a large, hard, nodular tumor of the thyroid gland. The tumor was removed and the histological examination showed ossification of the thyroid gland.



Fig. 2. Thyroid gland showing ossification (5).

and Bell (1) described a similar tumor causing dysphagia of trachea but in both these instances the tumors were calcareous and not osseous. In Bell's case the cortex of the calcified mass was ossified. Doubtless scattered areas of ossification in the thyroid are more often present than commonly supposed but I can find no reason to believe that massive ossification such as our patient presented is any other than a rare condition. Wells (9) believe that there seems to be no essential differences between the processes involved in normal ossification and in most instances of pathological calcification. Calcium salt seem to exert a specific influence on connective tissue cells causing them to form bone. On the basis of such a statement we naturally expect to find scattered areas of microscopic and small foci of microscopic bone in the thyroid because calcification occurs very commonly in the thyroid.

Pathologists are not in perfect agreement regarding the basis of underlying pathological calcification and subsequent ossification. Wells in his paper already mentioned says that calcium deposition seem to depend alike in normal and in most pathological condition rather on physicochemical processes than on chemical reactions and

Moschcowitz (6) seems in large measure to agree with this view in his statement that the development of new blood vessels affords the keynote to the interpretation in terms of cellular ontogeny of the process of ossification. Other authors ascribe to other causes the agency underlying pathological calcification and ossification.

On one point there is practical agreement, namely that pathological calcification and subsequent ossification may occur in any tissue<sup>1</sup> provided the tissue is dead or that its vitality has been reduced to a sufficient degree. This fact is of particular importance in relation to the thyroid for it emphasizes one phase of thyroid disease which we as surgeons seldom encounter but which should concern us more than it does now. I refer to the frequent occurrence of thyroiditis. We are accustomed to think of thyroiditis as an acute inflammation of the thyroid gland more or less menacing in nature and sometimes ending in suppuration. As a matter of fact thyroiditis is very frequently unrecognized and runs its course with so few manifestations of acute symptoms as not to arouse the suspicions of the attending physician. Kocher (4) says that this type of thyroiditis may be caused by chemical poisons or by bacteria and their toxins. The diseases which most commonly involve the thyroid are typhoid fever, measles, diphtheria, scarlet fever, erysipelas, influenza, cholera, malaria, articular rheumatism, parotitis, angina, pneumonia and

enteritis. Kocher says further that this type of thyroiditis has practically no clinical significance except in so far as it leads to functional alteration of the gland. Kaufmann (3) emphasizes this same point and quotes De Quervain and his pupils to the effect that in general infections there is frequently an accompanying thyroiditis simplex which consists of a microscopic non-suppurative inflammation of the thyroid gland. This inflammation is characterized by hyperemia, fluidification and disappearance of the colloid substance, growth and desquamation of the epithelium and infiltration of leucocytes and other round cells in the alveoli. Hand in hand with this process goes necrosis. We have already learned that necrotic tissue serves as a center for the deposit of calcium. If thyroiditis simplex is as frequent as the pathologists report it to be, then it is easy to understand why calcific degeneration occurs so frequently in the thyroid. Why ossification or at all events why massive ossification does not occur more frequently is not so readily explained.

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<sup>1</sup>Wells says (1) Even such highly specialized tissue as the ganglion cells of the brain may become calcified so completely that there results perfect calcification of the original cylindrical cell.

## PRIMARY PNEUMOCOCCUS PERITONITIS IN CHILDREN

By ALBERT H. MONTGOMERY, M.D., CHICAGO

ONE of the gravest abdominal conditions that may arise in childhood is an infection of the peritoneum by the pneumococcus organism. As a complication of pneumococcus infections elsewhere in the body, involvement of the peritoneum occurs in a small percentage of cases. This is the so-called *secondary* form which results from some evident focus such as pneumonia, tonsillitis or bronchitis. There is however a definite group of cases recognized in surgical literature in which the peritonitis is the only demonstrable lesion. That group spoken of as the *primary* form is the one to be considered in this article. Because the portal of infection is not known the condition is often referred to as the *idiopathic form*. A review of our knowledge in regard to these primary cases together with some facts observed in my cases may lead to an earlier diagnosis and a reduction of the extremely high mortality rate.

One striking factor that has been brought out in all statistics of pneumococcus peritonitis is the tendency of the disease to occur in females. Holt and Howland (7) say that girls are afflicted three times as often as boys. Burling (2) in 1911 reported 234 cases of which 17 were in girls and 62 in boys. Of 33 cases collected by Michaut (15) in 1901, 27 were in girls. More recently McCartney and Frazer (14) have expressed the opinion that the primary form is found only in girls. They believe that a careful analysis will show that all of the cases reported in boys belong to the secondary form. This opinion was evidently held by Du Parquet (16) in 1842 when he described these cases under the title of "The Essential Peritonitis of Young Girls."

Although it cannot be said that the disease is confined to children, the incidence in adults is so extremely small that it may be considered as essentially a disease of childhood. Most of the cases reported have occurred between the ages of 5 and 10 years. Griffith (6) says it has been known to appear congenitally. Klaus (10) reported a case in a 9 weeks old infant.

Dudgeon and Sargent (5) have described a fatal case in a boy 7 weeks old. An autopsy failed to reveal any point of entrance for the infection. In relation to the age and sex of these patients the history of one of my cases is of interest.

**CASE 1.** S. S., a boy 8 weeks of age was admitted to the Children's Memorial Hospital April 10, 1922. The parents stated that the child had been well until 2 weeks previously when it was suddenly weaned. Since then it had lost weight and had not been so jolly. Nothing else had been noticed until the day before admission when the baby became suddenly ill with fever, drowsiness and some difficulty in breathing.

**Examination.** The child was a well developed but poorly nourished infant, baby boy. He was apathetic and appeared to be quite tired. Breathing was thoracic and somewhat embarrassed. The skin was sallow. Nothing abnormal was found on examination of the nose, throat, heart and lungs. The abdomen was greatly distended and tympanic except for an area of dullness below the umbilicus. No masses were palpable; no peristaltic waves were visible; no signs of fluid could be elicited. Rectal examination was negative. The cranium was rather large and edematous.

A few hours after admission the child began to spit up a very small amount of greenish fluid. An hour later following a feeding of albumin milk and water the baby vomited a large amount of deep green fluid with a distinctly fecal odor. The stomach tube was passed and about 150 cubic centimeters of this fecal fluid was removed. A little blood stained mucus was obtained following an enema but no gas or solid material. The temperature was 103 degrees F., pulse 155 and white blood corpuscles 28,750. A diagnosis was made of acute ileus due to peritonitis and an immediate operation was advised.

**Operation.** Under ether anesthesia the abdomen was opened by a right rectus incision. When the peritoneum was incised a large amount of green odoriferous exudate. The intestinal coils were everywhere red and injected and covered with large plaques of easily detached fibrin. As the appendix was partially covered by fibrin and appeared to be slightly inflamed it was removed. A cigarette drain was inserted and the abdomen closed with catgut and skin silk.

**Subsequent course.** Water was given subcutaneously and by rectum in large amounts immediately after operation. Some vomiting continued during the first 24 hours but none after that. On the second day after operation the bowels began to move and

the abdominal tympany disappeared. The baby took food readily when the vomiting ceased and his general condition improved daily. Convalescence was slow and prolonged somewhat by an attack of acute coryza but 50 days after operation the wound was healed and the child went home in good condition. Bacteriological examination of the specimen of pus taken at the time of operation showed a pneumococcus in pure culture. Histological sections of the appendix failed to show any pathological changes.

The possible influence of bad hygiene is suggested by McCartney and Fraser. They point out that most of these cases have been found in charitable hospitals among patients whose home environment is not of the best. Griffith along the same line believes that alcohol and heredity play a part in the etiology.

Because of the frequent presence of diarrhoea Annand and Bowen (1) Bryant (3) and others think that preceding attacks of indigestion permit involvement of the peritoneum.

#### PATHOLOGY

The changes that occur are limited almost entirely to the abdomen. Most authors agree that the disease may be present either as a diffuse or a localized peritonitis. In the diffuse form the abdomen is filled with a green odorless pus containing numerous fibrin clots. The peritoneum is everywhere red and injected and covered in places by plaques of lightly adherent green fibrin. The changes are most marked in the lower half of the abdomen. The localized form is characterized by a well walled off abscess cavity filled with the same green odorless pus and lined with greenish fibrin. The abscess is usually located in or near the pelvis to the right or left of the median line. As the abscess increases in size it tends to point at the place of least resistance which is usually the navel. Here it may bulge or even rupture spontaneously.

Michaut believes that the diffuse form is caused by a virulent strain of the pneumococcus and the encysted form by an attenuated type of the same organism. Cameron (4) however regards the diffuse form as merely an early stage of the encysted form and not a distinct pathological type. Kahn (9) agrees with this viewpoint and says the pathological picture develops in a somewhat analogous way

to empyema. Aside from the changes in the peritoneum the abdominal organs show no pathology. Also in this primary form of pneumococcus peritonitis that we are considering the lungs, pleura, upper respiratory tract and in fact all other parts of the body appear to be normal. The lesion then is confined to the peritoneum and that brings up the interesting question discussed in the literature as to what is the portal of infection in the case of the so-called idiopathic cases.

It is evident that the infection can involve the peritoneum from (1) the blood (2) the lymph (3) the gastrointestinal tract and (4) the genital organs in the female.

The blood route has been suggested by Koplik (11) as a possibility. Rischbieth (17) who thought that pneumonia was the result of a pneumococcus septicaemia considered primary pneumococcus peritonitis as actually a secondary process produced by organisms circulating in the blood stream. However as it is generally recognized today that the infection in pneumonia enters by way of the air passages and that the septicaemia is a secondary condition it would seem probable that the septicaemia in pneumococcus peritonitis is the result rather than the cause of that condition. McCartney and Fraser think that if the peritonitic infection comes from the blood stream it should be a frequent rather than a rare complication in pneumonia where a septicaemia is always present. This objection however is not entirely valid for metastatic pneumococcus joint infections are also rare but they are undoubtedly due to infection from the blood stream. That the peritoneum can be infected primarily from the blood stream would seem quite probable from the history of the following case.

CASE 2. L. C. a white girl 3 years of age was admitted to the Children's Memorial Hospital on April 14, 1922. Her mother stated that 8 days before admission the child had awakened at 2 a.m. crying and complaining of severe abdominal pain and cramps. Hot applications on the abdomen gave only slight relief. The next day the child began to vomit. An enema was given with good results but the pain and vomiting continued. On the third day the abdomen became distended and the following day a soap suds enema was given which resulted in a stool which contained about a half cup of blood. This

relieved the distention somewhat but the pain and vomiting persisted. There was one bowel movement daily for the next 4 days but every stool contained 2 to 4 ounces of blood. The vomiting which was mucous for the first 5 days became yellow on the sixth day and had a fecal odor. On the day of admission it became chocolate colored. Fever has been present with marked fluctuations throughout the course of the illness.

**Prodromes.** The patient and all of her family had been sick for two weeks prior to the onset of the present trouble with sore throat associated with swollen glands in the neck. This condition was subsiding when the patient was seized with the attack of abdominal pain.

**Physical examination.** The patient was a fairly well nourished white girl about 3 years of age who was acutely ill. She lay rather quietly but cried out when the abdomen was touched. There was an occasional emesis of chocolate colored watery fluid. Her skin felt dry and the child was markedly dehydrated. The face was drawn and had a worried appearance. The mouth and teeth were dry, the tongue was covered with a dried red lusc debris. The throat was moderately reddened. The heart and lungs were normal. The abdomen was symmetrical and moderately distended so that the underlying viscera could not be palpated. No evidences of peristaltic movements were visible on the abdominal wall. On palpation there was a slight muscle rigidity noticeable all over the abdomen giving a somewhat doughy sensation when pressed upon. A moderate degree of tenderness could be elicited all over the abdominal surface. Rectal examination was negative. The temperature was 100.4 degrees F., respiration 25, pulse 160, white blood corpuscles 24,600. Microscopic examination of the stools revealed frequent clumps of pus cells. Only a very small amount of mucous chocolate colored fluid could be obtained when stomach tube was inserted and the procedure did not relieve the abdominal distention.

**Pre-operative diagnosis.** The history of a throat infection followed by bloody stools and vomiting of a nonobstructive type together with the picture of sepsis pointed to a diagnosis of ileocolitis. However the abdominal tenderness, rigidity and distention suggested very strongly the presence of a generalized peritonitis probably secondary to the ileocolitis. Under this diagnosis operation was advised and accepted.

**Operation.** Under ether anaesthesia the abdomen was opened by a midline incision. When the peritoneum was incised a green odoriferous pus exuded from the abdominal cavity. The intestinal coils were everywhere dark red in color and distended. All the abdominal viscera were bathed in green pus and plaques of fibrin were adherent to the intestines in many places. The appendix was somewhat injected and partially covered by fibrin and therefore it was amputated. A cigarette drain was placed in the pelvis and another in the right flank. The abdomen was closed with catgut and skin silk.

**Laboratory findings.** Cultures of the pus found in the abdominal cavity showed a pneumococcus in almost pure culture. Microscopic sections of the appendix did not show any pathological changes.

**Subsequent course.** The first two days after operation were rather stormy but the child was supported by salt solution given at frequent intervals by hypodermoclysis. She was kept at rest in a Fowler position by small doses of morphine. Vomiting ceased the second day after operation and the bowels began to move the following day. Abdominal distention now lessened and the patient took a small amount of food. The general condition of the child improved steadily. The wound continued to discharge until about June 1, 1922 when it was almost healed and the patient was discharged.

In this particular case we do not know the causative organism in the throat infection. If it was the pneumococcus this case should probably be considered as belonging to the secondary type. In any event it does seem to indicate that the peritoneum became infected by way of the blood stream. When we consider how frequently minor nose and throat infections occur in children and pass almost unnoticed it is not unreasonable to think that the blood stream might carry infection to the peritoneum. It is possible and it seems highly probable that some at least of these so-called primary cases occur by this route.

The lymphatic route has been suggested because of the very common lymphatic involvement in upper respiratory tract infections. The greatest objection to this route is the anatomical fact that lymph drainage from the neck does not flow downward as far as the peritoneum but enters the blood stream at a much higher level. To reach the peritoneum the infection would have to travel down retroperitoneally or through the mediastinum. We have no evidence pointing to either of these paths and it is highly improbable that they are ever involved in primary pneumococcus infections of the peritoneum.

The gastro-intestinal route is naturally thought of because of the frequency of such irritative symptoms as vomiting and diarrhea. Annand and Bowen say that the frequency of diarrhea and pain at the onset is very suggestive of enteritis passing on to peritonitis. The occasional presence of the pneumococcus in the intestinal flora and the finding of the organism as noted by Stoo (18)

in the subperitoneal tissue of the intestinal wall in cases of pneumococcus peritonitis have seemed to point rather strongly toward an intestinal invasion. It should be noted however that the pneumococcus has not been found in the bowel wall except in cases in which the peritoneum has been infected so that McCartney and Fraser aptly state that they think the intestinal wall was invaded from the peritoneum rather than vice versa. These authors repeated some unsuccessful experiments of Jensen's (8) in which rabbits were fed virulent cultures of pneumococci in an attempt to produce peritonitis but the results were negative. McCartney and Fraser point out that there is no demonstrable lesion of the mucosa although such a lesion should be present necessarily if the infection passed through the mucosa from the bowel to the peritoneum. However it might be assumed in these cases when we have a diarrhoea and an enteritis that such a lesion is present and demonstrable.

The female genital tract. It is a well established fact in gynecological pathology that the peritoneum can be invaded by infection from without by extension from the fallopian tubes. Tuberculosis and gonorrhoeal infections of the peritoneum are known to enter by this route. McCartney and Fraser argue very strongly in favor of this avenue of infection. They state that the process begins as a pelvic peritonitis which either spreads or localizes. Other observers have noted the frequency with which the process is confined to the pelvis and lower abdomen. Very logically McCartney and Fraser point out that if the infection occurs by the genital route in primary pneumococcus peritonitis the disease must be limited to females. This they believe is actually the case for after reviewing a series of 56 cases of pneumococcus peritonitis they found 36 that they considered primary and all of these occurred in girl. Furthermore they claim that these primary cases occur only in girls of the poorer classes who are subjects of poor hygiene. From girls of that kind they have found pneumococcus organisms in the vaginal smears. To substantiate their belief they took cultures from the throat, the blood, the vagina and the upper and lower parts of

the peritoneal cavity in 10 cases. In every case they isolated a pneumococcus of the same type from the vagina, blood and peritoneal exudate. Cultures from the throat also showed the pneumococcus but in one case the organism was of a different type than that found in the abdomen. They also found that cultures from the upper abdomen were very light or were negative while those from the pelvis were very heavy. This would seem to point to an infection beginning in the pelvis. If we sum it all up there can be little doubt from all the evidence gathered by McCartney and Fraser that in many cases of primary pneumococcus peritonitis the infection enters by way of the female genital tract.

However that only girls are affected is doubtful for I have reported a primary case in an 8 weeks old boy and other observers have seen this condition in males. In such cases the infection must have gained entrance by the blood stream or the gastro intestinal tract.

The clinical picture presented by these cases of primary pneumococcus peritonitis differs somewhat according to the underlying pathology. Michaut in 1901 described the symptoms as seen in the circumscribed form in three phases. The onset which he calls the meteoric phase begins with a sudden attack of acute pain that soon spreads over the entire abdomen vomiting that is profuse and persistent diarrhoea which may show bloody stools and fever. This phase passes to a more chronic condition after a week or 10 days and becomes encysted with abscess formation. The fever which has been rather high begins to moderate the vomiting lessens or disappears. Examination of the abdomen shows signs of abscess formation usually below the umbilicus and lateral to the median line. This condition is spoken of by Lennander as abdominal empyema. If not relieved by surgery the condition will pass on to the perforative phase in which evacuation of the abscess occurs spontaneously by rupturing at the navel in the vast majority of cases. In rare instances perforation may occur into the bowel, vagina or bladder.

The diffuse form of primary pneumococcus peritonitis is a more serious picture. The onset is sudden with high fever, intense ab-



dominal pain rapid prostration copious diarrhoea and persistent vomiting. This is soon followed by deliriumordes typical facies cyanosis and cold extremities and in many instances early death. Abdominal examination shows a singular absence of localized tenderness or rigidity. There is some distention present either generalized or localized usually below the umbilicus. There is a peculiar doughy feeling of the abdomen in many cases described by Lacker Syms (19) and Marshall (13). It was present in the 2 cases described here.

The diagnosis is rarely made in the diffuse form before the abdomen is opened. It should be thought of in those acute abdominal conditions especially in girls which show sudden onset with great prostration severe toxæmia marked nausea and vomiting with a striking absence of localized pain muscle spasm and tenderness but with some tympanites and rigidity.

The localized form is more readily diagnosed because of its more gradual onset with the increasing signs of abscess formation in the lower abdomen pointing toward the navel. Von Brunn (20) believes that the spontaneous rupture at the umbilicus in these cases is pathognomonic of primary pneumococcus peritonitis. In cases in which the abdomen is opened the finding of green odorless pus containing flakes of fibrin is recognized by Wolsky (21) and Lacker Syms as definitely characteristic. Syms believes that many cases of streptococcus peritonitis are possibly of pneumococcus origin. Unless careful bacteriological tests are made this may take well on.

Differential diagnosis. The condition lacks the localized tenderness and rigidity of appendicitis. The diarrhoea is also in contrast to the usual constipation of appendicitis. The marked tenderness and rigidity present in cases of peritonitis due to a ruptured vesicle is quite different from the mild abdominal rigidity found in pneumococcus cases where it is noticeable how much easier the patient seems than the abdominal examination indicates. Typhoid fever has a leucopenia instead of the high leucocytosis of pneumococcus peritonitis. As in typhoid fever there is a history of the onset of fever preceding the

pain, whereas pain is the initial symptom in the pneumococcus patients. Tuberculous peritonitis resembles the localized form of pneumococcus peritonitis but it has not the history of an acute sudden onset and it runs a much longer course. However some of the milder localized cases have an insidious onset that may present a very baffling resemblance to tuberculous peritonitis.

Generalized peritonitis is always a very serious condition especially in children. In primary pneumococcus peritonitis the earlier writers have reported a mortality of 50 per cent or more. They advise against operation except in the milder cases when an encysted collection of pus can be drained. Parker Syms believes that operation is always fatal in the diffuse form and should not be performed unless a localized abscess form. He says this is the only exception to the rule of immediate operation in generalized peritonitis. Kahn who believes that the diffuse form is only an early stage of the encysted form advises supportive treatment until a definite abscess develops. Libenthal (12) thinks that the disease like gonococcus peritonitis could never be treated by peritonectomy.

On the other hand Fraser and McCartney are strongly in favor of immediate operation under general anesthesia with drainage. They report a mortality of 33 per cent which although high is a marked improvement over the earlier statistics. More recently they have been using bilateral trephination in addition to the peritoneal treatment and their mortality is down to 42 per cent.

There is probably a rather general idea among surgeons that the encysted cases should be watched until they are well localized. They may then be drained with a fair degree of safety. In the diffuse form the probability is more doubtful. It is true no doubt as Kahn has said that we cannot drain the peritonitis by any peritoneal procedure. There is however in these cases a certain amount of intra-abdominal pressure that tend to increase the diffusion of toxin by the peritonium. The intra-abdominal tension can be relieved by a simple opening of the abdomen and the introduction of drainage. The operation should be a brief incision in a traumatic as pos-

sible. The patient should then be put to bed in the Fowler position and kept at rest with morphine. Plenty of water must be given by rectal drip or subcutaneous. Hot packs may be used on the abdomen if they do not disturb the patient. In the diffuse form of primary pneumococcus peritonitis the combination of immediate simple operation, absolute rest and strong supportive treatment has given us more favorable results than the supportive treatment alone. Under the latter only too many patients die unfortunately before any localization can take place. The operative treatment would seem to give them a somewhat better fighting chance.

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# A CLINICAL SURVEY OF THIRTY CASES OF PROVED TUBERCULOSIS OF THE PLEURA<sup>1</sup>

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IN man's attempt to withstand the onslaughts of various types of injury during the course of life there has been developed a protective mechanism that operates with more or less efficiency so that he has been able to ward off the phenomenon that we know as disease. All such phenomena are due to some sort of injury and call forth from the body certain responses of which inflammation is an important one. Associated with these reflex phenomena of vascular and cellular changes incident to injury is the production of immunity which enables future traumas of similar type to be met without danger and the more immediate process of repair which permits tissues attacked again to assume their normal function.

As a subclass of inflammation is the process of chemotaxis by which certain cellular elements are attracted or repelled by the noxious agent itself or by its products. In the pleura these responses occur as in all other tissues and the nature of the changes corresponds to the extent of injury to the chemotactic action on cells to the broadening of the vessels so that fluid materials may be poured out to the ability of the noxious agent to withstand the attack made on it and finally to the ability of the body to clear away the debris and repair damaged tissue.

It is quite important then to recognize that various results will follow the intervention of the same irritant depending on the amount of damage to tissue, the virulence of the noxious agent, and the protective forces employed to combat it. For this reason we see in the pleura attacked by a single organism evidences of pleuritis that we arbitrarily divide into types known as fibrinous, sero-fibrinous, hæmorrhagic and purulent. It would be impossible to segregate these inflammations of the pleura into any really sharply defined groups with either characteristic clinical or pathological pictures.

The material studied in this investigation comprises thirty cases of proved tuberculosis of the pleura including both primary and secondary forms as well as those in which both serofibrinous and purulent exudates have existed. In the main these patients have shown evidences of primary disease of the pleura but one must realize that the supposedly primary disease such as primary disease of the peritoneum may really be a secondary condition the primary one not having been discovered at the time of examination.

In this series there were twenty-one men and nine women whose ages varied from 15 to 59 years. In the second decade there were three patients in the third fourteen in the fourth seven in the fifth two and in the sixth four. They came from widely separated areas the Atlantic states being represented by two the middle west by seven the south by two and the southwest by one twelve states in all while two foreign countries were represented and two patients were wanderers without definite location. In so widespread a disease as tuberculosis this wide distribution is quite to be expected. Tuberculosis is a disease which affects all people regardless of location, race or occupation. Twelve definite occupational groups were represented in the series.

Farm rs	8	Stenographer	1
Housewives	5	Insurance agent	1
Student and teacher	5	Electrical engineer	1
Oil field workers		Brakeman	1
Laborers		Baker	1
Mine and granite workers		No occupation	1

At examination the complaints were various but 50 per cent of the patients came because of sinuses persisting after operations on their chests. These sinuses had existed for from 2 months to 19 years.

Six of the patients had reported that they were first ill with influenza. This has become

a common report by patients with all types of sickness probably because following the epidemic of 1918 many minor troubles were ascribed to influenza. The patients became weak having fever that ranged from 100 to 101 degrees but of irregular type they were often fatigued easily and had anorexia and more or less indefinite pain in the chest although it was sometimes referred to the abdomen. Cough developed and was productive of sputum that was described as slight moderate or profuse and in two instances as malodorous. Influenza may have been the forerunner of the illness in a few cases but it attacked so many persons that symptoms were familiar and a diagnosis was often made by the patient rather than by physicians so that it is doubtful whether influenza in itself was the precursor of the disease.

In eighteen of the thirty cases the history of illness was so insidious that it was reasonable to believe that the infection was tuberculous from the beginning. In fourteen cases the onset was definitely characteristic of pleurisy. Some of the patients complained of soreness throughout the chest and later developed pain on inspiration but others had sudden knife-like agonizing pains increased by inspiration and by coughing. One patient reported that the chest became immobile and enlarged before a diagnosis of fluid collection was made and one patient suffered from aphonia. This was the only instance of pressure phenomena recorded. Others may have had circulatory changes such as cyanosis venous engorgement or tachycardia.

However fluid had been found at the first thoracentesis in eighteen instances it was serous in eleven instances and turbid or purulent in seven. From the descriptions given there would seem to be no question concerning the serous character of the fluid whereas there might be some doubt about a report of purulent exudate because when such a report was made the disease had been of such long duration that a description of the original material removed could not be accepted as entirely accurate. The number of serous effusions was probably greater than that reported while the number of purulent effusions was probably less.

Many operations had been performed before examination at the Clinic these had included rib resection tube drainage and aspiration. Fifteen patients had had rib resections an average of 11 months before examination the shortest time being 2 months and the longest 24 months before. In two other cases rib resection had been done 6 years and 19 years before respectively. One patient had had a drainage of undescribed character 4 months previously seven had been aspirated an average of 11 months previously and two had had no operation but they had been ill on an average of 7 months ranging from 1 to 24 months.

There were twenty five patients who had histories negative for tuberculosis in their families one patient had had a sister with tuberculosis one a grandmother one both a sister and a brother and two did not know the family history. One would conclude that so far as this series is concerned no relationship existed between the illness of the patient and any hereditary tendency.

#### APPEARANCE

Patients ill so long and with such a chronic and debilitating disease would necessarily show evidence of their illness in their general appearance. Eight of the patients looked decidedly ill eight poorly nourished five slightly undernourished four well nourished six anæmic and five extremely weak.

Loss in weight as in all other chronic debilitating diseases was apparent. There was a minimal loss of 15 pounds or 18 per cent of the normal weight a maximal of 49 pounds or 28 per cent and an average of 18.3 pounds or 12.3 per cent. One patient had gained weight three had maintained their normal weight and a record of the weight was not obtained from three.

#### BLOOD PRESSURE

The average blood pressure was somewhat lower than normal. The highest blood pressure was 144 systolic and 84 diastolic the lowest 98 systolic and 74 diastolic and the average 117 systolic and 77 diastolic. This is in accordance with the average blood pressure readings in diseases of this type and corre-

sponds fairly closely with the blood pressure in cases of tuberculosis elsewhere in the body

#### CLINICAL FINDINGS

The pulse rate was elevated the highest being 130 each minute the lowest 72 and the average 103. Temperature also showed a similar elevation ranging from 103 to 97 degrees the average being 99.4 degrees.

Examinations of the sputum were positive in the two cases in which the pleurisy could be definitely considered a secondary disease.

#### THE CLINICAL DIAGNOSIS ON PRIMARY EXAMINATION

	Cases
Chronic empyema	23
Hydropneumothorax	3
Tuberculosis (?)	10
Osteomyelitis	1
Empyema with sufficient drainage	2
Empyema with bronchial fistula	
Isolated effusion	6
Empyema with infected drainage	4
Abscess of the lung	
Intercostal aneurysm	1

#### CONDITIONS INDICATIVE OF TUBERCULOSIS

One patient had had cough and expectoration 7 years and had previously been treated for tuberculosis. He then had repeated attacks of minor infections that simulated influenza with fever, chills, pain in the chest, slight cough, slight expectoration and frequent night sweats. He was in bed for several months.

A second patient had repeated attacks of sudden and abrupt illness for 2 years previous to coming to the Clinic with each attack pains in the chest increased on breathing followed by a long and tedious convalescence.

A third patient had an illness with a very slow insidious onset with malaise, weakness, cough, expectoration and a history of having had eleven aspirations for removal of straw-colored fluid 10 years before.

A fourth patient had an abrupt onset of pleurisy characterized by knife-like pains, fever of 103 degrees and a voluntarily controlled cough. There was a prolonged convalescence with weakness following fullness in the chest. Three months previous to admission he had had a definite pulmonary hemorrhage of 4 ounces of blood.

A fifth patient had an abrupt illness with a long convalescence characterized by general malaise for 2 months. Two months later there was a definite history of pleurisy and his home physician made a diagnosis of tuberculosis.

A sixth patient had an illness the onset of which was said to be due to grippe but was really characterized by malaise, loss of weight, night sweats and a soreness in the side which soon developed to definite pleuritic pains. One sputum examination was reported as positive for the bacillus of tuberculosis. This patient was the only one who developed aphonia. The latter seems to have been associated with the complete collapse of the left lung which was revealed on physical examination.

A seventh patient had a sudden onset of illness with what was diagnosed as pneumonia 15 months previous to admission followed by a very slow convalescence, gradual onset of cough and then increasingly productive sputum. He had vague chest pains for 2 months before a sense of fullness in the chest appeared. Air was obtained on aspiration. Asymptomatic spontaneous pneumothorax was diagnosed.

An eighth patient 2 years before admission had general malaise with weakness, fever, headache, cough, sputum, night sweats, continuous illness and a history of a gradual accumulation of serous fluid in the chest. He had had no pain in the chest.

A ninth patient had an onset with pain in the chest increased by inspiration, shortness of breath, non-productive cough, fever and findings of clear fluid.

A tenth patient had an insidious onset 1 year before admission of malaise and cough, irritating but non-productive. He had been ill for 3 months before sputum appeared and had developed dyspnea on exertion.

An eleventh patient had suffered from general malaise with loss of vitality and appetite. His capacity for work was decreased and production of malodorous sputum with the cough gradually increased until there was as much as 8 ounces at a time. The patient became markedly dyspneic, had palpitation and symptoms suggestive of spontaneous pneumothorax.

A twelfth patient 2 months before admission had low grade fever continuous persistent weakness and shortness of breath

A thirteenth patient 1 year previous to admission had general malaise with weakness loss of appetite and loss of strength Fluid was found early six aspirations each produced a quart of fluid the last one was made 3 months before examination The temperature ranged from 99 to 101 degree Shortness of breath was relieved by each aspiration

A fourteenth patient was a young woman who after her first pregnancy developed fever without evidence of infection in the pelvis During her slow convalescence she had definite sharp pains in the chest which increased on breathing Clear fluid was obtained 3 weeks after onset by tapping

A fifteenth patient had a long illness with cough persisting for months which was productive of sputum sometimes containing blood streaks

A sixteenth patient known previously to have pulmonary tuberculosis had an insidious onset of fever developed mild pleuritic pains later becoming sharp and evidence of serous fluid collecting gradually This case was observed from the onset

#### TYPES OF SYMPTOMS

In reviewing the symptoms in the histories in these cases it is noticed that the cases fall naturally into three groups according to their symptoms

First and most typical are the cases in which there is an insidious onset of general malaise including slight fever from 99 to 101 degrees weakness easy fatigability nervousness cough and indefinite pains in the chest either remaining as such or developing into acute stabbing pains associated with increased severity on inspiration The pain in this type of case usually lessens with gradually increasing amounts of fluid The dyspnea depends entirely on the rapidity with which the fluid collects A few patients have reported on examination that they were able to do severe athletic exercise a few days before admission at which time one side of the chest was found to be completely filled with fluid and the mediastinum markedly displaced In those

in whom the chest filled rapidly with fluid dyspnea was acute and in rare instances tachycardia aphonia giddiness and cyanosis occurred and in one case a painful swelling of the arm on the affected side

It is important to keep in mind the ubiquitous nature of tuberculosis It like syphilis should always be remembered as a diagnostic possibility Any cough lasting more than 3 weeks is a symptom to be carefully appraised Fever requires equal discrimination particularly if the patient has never appeared to have an unstable nervous mechanism In this group of course the longer the fever lasts and remain unassociated with other phenomena the more likely it is to be due to neurosis alone and not to tuberculosis This is an important consideration Many patients are observed who have had fever for months or even years who have been classified and treated as tuberculous yet in whom no evidence of such disease could be found by any means at our disposal Fever is one of the reactions of the body which should not persist singly for a prolonged period

The second group of cases comprises those in which the patients are acutely ill from the onset and in some of which chills have been the initial symptom The latter however is an unusual finding in tuberculosis and ordinarily would be a contra indication to a diagnosis of tuberculosis yet they will appear first occasionally at the onset of the disease or second if there is a rapid transfer of large numbers of organisms to other portions of the same organ or to distant organs As a rule these patients suffer severely with acute pleural pain and have a higher fever than the first group as high as 103 and 104 degrees but at the termination of the acute stage they commonly take on the same characteristics as in those in whom the onset is more insidious

The third group comprises patients who have the characteristic onset of pulmonary tuberculosis They also are likely to have an insidious onset with malaise weakness tachycardia slight fever loss of weight nervousness and a slight productive cough Two of the group in whom we suspected tuberculosis though they came with definite signs of emphysema and draining sinuses had such an onset

and gave a definite history of hemorrhage of bright red blood in amounts larger than a dram while another had had blood streaked sputum for a long time. In this instance the productiveness of the cough bore a definite and direct relation to the duration of the illness.

The fourth group in the series comprises the young women who following pregnancy develop an illness with inchoous onset similar to that in the preceding group. The illness can not be attributed to the pregnancy itself nor to the type of labor. It is so well known that patients who have had a tuberculous lesion at any time in their lives may develop signs of acute re-involvement following labor. This group is always important and the onset of such an insidious illness after labor warrants a suspicion of tuberculosis. If a sterile serous effusion is obtained from the pleural cavity it constitutes evidence for tuberculosis as accurate as a hemorrhage.

It should be noted that in these four groups were eighteen patients eleven of whom had had a history of removal of serous effusion. The twelve other members of these groups had histories of illness that could not possibly be construed as tuberculosis seven of these reported that the material aspirated was purulent in character though as noted before some doubt may exist as to the accuracy of this report. It is quite possible that the description was faulty in which case the number of serous effusions would be increased. The patients had no knowledge of the cytological characteristics of the removed fluid its infectious agents or its sterility the results of animal inoculation or whether any such tests had been made before drainage and other measures were instituted.

#### X-RAY DIAGNOSIS

When patients come for examination after having had various types of operation or other interference with the pleura and often for months or even years the X-ray can hardly be expected to diagnose accurately the primary or underlying cause of their trouble. The pleura becomes impervious to light the lung is often fibrosed and dislocation of the

mediastinal organs occurs. In this group in which the condition ultimately proved to be pleural tuberculosis empyema was diagnosed in eight instances increased density in fourteen, fluid alone in fifteen pneumothorax or pulmonary collapse in six Pott's disease in one instance pulmonary tuberculosis in eight instances while abscess was suspected in two in which large amounts of malodorous sputum were obtained by change of position and cough. In all probability these cases were due to the induration of the lung with fibrosis and the formation of bronchiectatic cavities rather than true abscess. That is the roentgenogram could yield only the information that the pleura was involved or that fluid was present because the chest was impermeable to the ray. The roentgenogram was extremely important in revealing evidences of tuberculosis in the lungs in eight cases and of associated tuberculosis in other parts of the body in one case of Pott's disease.

#### BLOOD COUNTS AND OTHER TESTS

It is somewhat surprising that a greater change was not found in the blood counts in these patients. One would expect that debilitating disease over a long period would have produced a more marked secondary anemia. The highest hemoglobin by the Dare method was 89 per cent the lowest 56 per cent and the average 66 per cent. These figures are in agreement with those obtained in a survey of cases of tuberculous enteritis in which the highest hemoglobin was 85 per cent the lowest 30 per cent and the average 65 per cent. The number of erythrocytes likewise was higher than might have been expected the highest count being 5,650,000 the lowest 2,500,000 and the average 4,350,000. The leucocyte count was interesting the highest count was 20,800 while the lowest was 5,600 and the average 10,000.

Considering that many of the patients had had serious operations on the chest with inevitable mixed infection an average of 10,000 leucocytes is not unexpected. One is inclined to believe that a tuberculous infection will not produce a high leucocyte count and any count under 10,000 naturally suggests the possibility of this disease. However in

the presence of mixed infections and most of them of long duration any rule regarding number or character of cells is lost and the leucocyte count is not of diagnostic aid. However in the cases in which operation had not been performed the blood counts followed the usual rule in tuberculosis and were lower than normal.

Cultures smears and guinea pig inoculations were made in all of the cases from one to eleven times each. From the culture or smear three positive findings were obtained. As my experience with chest cases broadens the direct smear from sinuses is becoming of increasing importance and positive diagnoses have been made in a considerable number of cases by this method alone. This method has also been of great value in testing for actinomycosis and even in a very few instances *Endameba histolytica*. I believe that such an examination of any draining sinus about the chest or indeed other regions of the body is quite necessary.

Guinea pigs were inoculated from materials obtained from the chest and cultures were positive in nine cases and negative in four. They were not inoculated in a number of instances in which the diagnosis was positive by culture and smear or pathological test. By the latter methods findings were positive in seventeen tests. It is quite possible that negative reports may be obtained in the first examination of tissue like that of smears or even of guinea pig inoculations. In the seventeen positive reports on tissue five of the tissues had at some time been reported as inflammatory before the positive pathological specimen was obtained. Repeated examinations should be made in these tests before making a final report of a negative result just as in sputum examinations.

#### LATE REPORTS FROM SURGICAL PATIENTS (1923 TO MARCH 1925)

The patients on whom we were forced to operate because of widespread secondary infections were almost all dismissed with granulating wounds and either sent home for further treatment or to sanitariums where their tuberculosis could be more satisfactorily treated. It is rather surprising to find that a

large number finally responded to treatment and to receive reports years later that seven of the patients had been able to return to productive life and were in very good general health. Five were reported in poor condition and unable to work five have not been heard from and thirteen have died.

#### OPERATIONS

No operative procedure other than aspiration was done in cases in which there was serous effusion or sterile turbid effusion but in cases in which there were draining sinuses and resultant infection empyema pockets and remarkably thickened pleura sometimes 1.9 centimeters in thickness various types of operative procedure were necessary including rib resection decortication skin flap operations resection of sinus tracts cauterization of fistula and Schede's operation. These operations are for the purpose of assisting the usual phenomena of inflammation which comprise not only the attempt to discourage or kill the noxious agent and repair the tissue damage but also the carrying away of the debris (MacCallum). Operation assists especially in this third phase of inflammation inasmuch as purulent material cannot be absorbed readily and one of nature's methods is to allow fibrin to remain in place and to change it into scar tissue. In diseases such as tuberculosis in which the offending organism does not die but becomes a continuous irritant large masses of fibrin are laid down layer after layer ultimately resulting in very dense thickening of the visceral and parietal pleura leaving a condition which must necessarily be treated surgically because of the mechanical inability of the cavity to collapse. Consequently chronicity is inevitable and permanent subject to recurrence of acute exacerbation unless thorough surgical interference is instituted.

#### PREVIOUS WORK

Lord's findings in two types of pleurisy are most important. In the acute fibrinous type he found that 64.6 per cent of the cases were regarded as primary but agreed that thirty other cases may have been due to exposure and of the *a frigoris* type. With regard to the secondary type, he believes that infection with



the bacilli of tuberculosis particularly in the lung or bronchial lymph gland may be regarded as the starting point in a large number of cases. He believed that there was pulmonary tuberculosis in 52 per cent of eighteen cases bacilli of tuberculosis being found in the sputum in 18 cases. In the serofibrinous group there were 750 cases apparently primary (63.4 per cent of 1185 cases). Tuberculous serofibrinous pleuritis comprises the largest and most important group while non tuberculous infection comprises a much smaller group and other cases such as transudates in which an inflammatory process has been superimposed form a still smaller group. In the last group it would seem that cases of serofibrinous pleuritis such as in Hodgkin disease and lymphosarcoma often observed at the Clinic might be included. Doyle and I were able to demonstrate serous effusion in 30.7 per cent of patients having Hodgkin's disease with mediastinal involvement. In the secondary cases Lord believed that there was light or positive evidence of pulmonary tuberculosis in 13.5 per cent of 160 cases. The lung was tuberculous in 149 and 41 had the bacillus of tuberculosis in the sputum. Such data support the belief that a large proportion of cases of serofibrinous effusion more especially those of the primary type as well as those in which pulmonary tuberculosis is associated are essentially tuberculous in character. Accordingly all such cases should be considered as tuberculous unless they can be proved otherwise. Such an assumption would have prevented the open and dangerous operations that were productive of empyema in my series of cases. Lord gives several reasons as proof of the correctness of this assumption. He quotes Oler's 193 cases in 30 of which the bacillus of tuberculosis was found in the sputum. He believes that serofibrinous effusion is one of the most important signs of pulmonary tuberculosis and that it is a very early manifestation which is necessarily true because the pleural space becomes obliterated later.

All diseases of the lungs acute and chronic may and usually do cause pleural irritation or pleurisy with sufficient inflammatory reaction to be clinically discernible. In apical tuber-

culous lesions the pleura is involved early and thickens with coalescence of parietal and visceral layers. The advancing pleuritis keeps pace with the advance of the lesion in the parenchyma and acts as a protective mechanism without which the recurrent known as spontaneous pneumothorax would be common rather than comparatively rare. The subsequent history would show that from 35 to 40 per cent of such patients develop manifest pulmonary or other tuberculosis within 6 years. The evidence of the truth of these assertions of Lord may be found in the report of Hedger, Sokolowski and Bowditch and in the actual figures quoted by Norm and Landis. The postmortem evidence from 131 necropsies in different types of pleuritis examined by Oler showed that 32 were definitely tuberculous. The tuberculin reaction in these cases is usually positive. He quotes the figures of the Massachusetts General Hospital there being 36.65 per cent positive reaction in 47 cases. One may add that Chon was of the importance of the tuberculin reaction that in every instance in which he was unable to find the primary site of the disease he made a most careful dissection of the whole body being confident that the primary site would be discovered if the tuberculin reaction were positive. He thinks that there should be a preponderance of lymphocytes in a large proportion of serofibrinous fluid with primary pleurisy and effusion but does not believe the cytological formula of Widal is an invariable proof.

#### HEMORRHAGIC EFFUSIONS

When hemorrhagic effusions are found in the chest one is inclined to believe that either tuberculosis or cancer is present. This is not necessarily true because sometimes in very acute conditions hemorrhagic fluid is found in man and in experimental animal. Sanguineous fluid was found repeatedly during experimental work on dogs in which the irritant was introduced intratracheally. Since it must be assumed that the majority of pleural effusions are inflammatory it would therefore be expected that as an evidence of inflammation and the broadening of the blood channel erythrocytes would be found in the

effusion. As in the examination of the urine the findings are divided in two groups the grossly hemorrhagic and the microscopically hemorrhagic. Dieulafoy found that it requires from 1500 to 3000 erythrocytes to each cubic centimeter to make any appreciable alteration in color and from 5000 to 6000 to produce a rosy tinge to the fluid. Naturally the more erythrocytes there are the more hemorrhagic the fluid will be. In my experience definite hemorrhagic fluids have most often indicated the presence of malignant disease but tuberculosis is particularly in young patients must always be suspected because primary tuberculosis is essentially a subpleural infection. The associated vascularity of the part aided by the varying negative pressure incident to respiration provides the mechanism for the liberation of erythrocytes and serum into the pleural space. The irritation can easily provide for leakage as a result of the degeneration of the small vessels and the resultant involvement of the vessel by the tuberculous process. Norms and Landis are of the opinion that the condition is similar to hemoptysis which is a forerunner of acute tuberculosis.

One interesting finding in hemorrhagic effusion is in the eosinophilia that occurs sometimes both in the effusion and in circulating blood. This is a peculiar reaction that sometimes obtains as a result of infections of various kinds. Dieulafoy found 35 per cent of eosinophils in effusion and 10 per cent in circulating blood but as high as 76.4 per cent has been found in effusions with 40 per cent in the blood. Approximately eighty such instances have been reported but I have been able to find only one instance in which the bacillus of tuberculosis was located in the hemorrhagic fluid.

It is very rare for a sterile exudate of a fibrous pleurisy to change from serous to purulent. Lord in his 1185 cases observed this change in only 1.3 per cent. In my own experience it has been even more rare. It is only after interference that such a change is apparent. Purulent conditions however are apparent when secondary infection occurs from repeated aspiration from infections due to open operations or when the interior

of the lung is connected by a fistula with the pleural cavity.

Duboff in a clinical study of twenty cases of tuberculous empyema which he defines as a purulent effusion into the pleural cavity caused by the bacillus of tuberculosis found fourteen persistent pulmonary tuberculosis which was able to demonstrate acid fast bacilli two cases were negative and four were not tested. He believes that tuberculous empyema differs from postpneumonic empyema in the underlying persistent pulmonary tuberculosis which is nearly always present and obvious. Clinically the process is an extension to the pleura from the lung itself and usually occurs by rupture although no evidence of communication and no signs of coincident pneumothorax may be found. Often however the picture is that of spontaneous pneumothorax with pain, dyspnea and fever followed by the effusion at first serous and then seropurulent. Unlike most observers Duboff believes that the bacillus of tuberculosis can almost always be found in the purulent effusion and that mixed infections are uncommon before the stage of fistula formation. He thinks that communication with the bronchi is not absolute evidence of mixed infection doubting whether pyogenic organisms are found in the small bronchi. He challenges the usual belief that empyema is not an accumulation of pus in the ordinary sense of the word and that the causative microorganism is seldom present. He thinks that the bacillus of tuberculosis in the effusion is as common as it is in the sputum of tuberculous patients. In his series one of the most important causes was the rupture of the lung due to artificial pneumothorax and thus in all probability is one of the most common seen by sanitarium workers because in many instances a fibrous caseating lung containing a subpleural cavity subject to the repeated strain of coughing may break down and subsequently rupture into the pleura.

This may occur not only because of cough but also because of the tearing of adhesions while artificial pneumothorax is being produced. As a complication of tuberculous however he found only 6 cases of tuberculous empyema out of 902 a total of 2.2 per cent. Twenty eight patients were treated

Heller described collections of lymphadenoid tissue in the visceral pleura and noted that they formed counterparts to the bronchial lymph nodes. Similar lesions affected both sets of glands. Netter could determine in four instances that the empyema was independent of any other lesion.

Hodenpyl was often able to find at necropsy on adults a more or less thickly studded pleura with tiny white circumscribed nodules or patches that were not simple fibromata or fibrous hyperplastic growths the result of pigment but in most instances he believed the result of miliary tuberculosis the miliary tubercles being frequently found on the pleura without parenchymal tuberculosis and particularly likely to undergo healing changes. If however healing is not complete fresh tubercles will form in the surrounding areas of lowered resistance and by caseation and rupture allow the escape of germs resulting in an exudative inflammation producing serum fibrin and pus. Of Hodenpyl's 131 necropsies on adults from 14 to 92 years of age in forty-five nodules were found on the visceral pleura which he believed were miliary nodules this was later proved in forty-one instances.

There are of course many mechanical possibilities for primary tuberculosis within the pleura as bacilli may be carried by the blood stream or by the lymphatics directly from the air vesicles bronchial lymph nodes chest wall or from foci within the neck and very often fresh tubercles are seen in the tissue of low resistance surrounding a primary lesion. If the original lesions are close to the pleura one has no hesitancy in believing that the pleura may be involved by disease starting with symptoms characteristic of primary pleurisy. Therefore the clinical evidence from the history and the examination may give a high percentage of cases of primary pleurisy due to tuberculosis yet it must be remembered that the pleura like the peritoneum is most often subject to secondary disease.

#### INDICATIONS FOR REMOVAL OF FLUID

From the cases studied it is evident that serious damage can be done by hasty or ill

considered operation on the patient with either a serous or a sterile purulent effusion. From the standpoint of treatment it is essential that all cases should be considered tuberculous for only then will certain restrictions be observed. There are five working rules for the removal of fluids: (1) fluid may be removed by tapping for the purpose of making precise laboratory examinations; clinical examinations are naturally unsatisfactory in determining the character of fluid within the chest and without obtaining the exudate itself a positive diagnosis is in many instances not possible; a presumptive diagnosis only being possible; (2) if pressure symptoms are present such as aphonia dyspnoea cyanosis tachycardia and cardiac failure the removal of fluid is permissible; (3) when the chest contains so much fluid as to cause mediastinal dislocation a sufficient amount may be withdrawn to restore the mediastinum approximately to its normal position; (4) pleural effusions that fail to be absorbed after a sufficient time interval may be withdrawn with justification; and (5) when the fluid is located bilaterally it should be removed. Recently a method of withdrawing fluid from the two sides through one suction apparatus has been devised. This device was necessary in the case reported because of symptoms developing from dislocation of the mediastinum and resultant cardiac failure. It never seems wise to withdraw all the fluid and frequently the withdrawal of only a small amount will disturb the equilibrium sufficiently to stimulate rapid absorption. Clinical experience has shown that whereas aspirating a large amount of fluid seems to stimulate further exudation aspirating a relatively small amount results in an augmented rate of spontaneous absorption (Hedblom). With an infectious serous effusion as is sometimes seen in streptococcal pleuritis the onset of empyema is to be expected and although aspiration is indicated yet tube drainage or rib resection may be necessary. In cases of sterile purulent effusions similar rules hold also. A study of this series of cases seems to prove that it is a mistake to assume that the presence of such purulent effusion is necessarily damaging. As a matter of fact many authors believe that

the lung is improved by its presence through an established immunity. Hedblom says:

Patients with sterile purulent exudate are of the type most liable to become the victim of injudicious surgery. This condition represents an exception to the rule *ubi pus ibi evace* for the simple reason that there is no pus in the sense of the word used in this hackneyed phrase. Certainly the one important lesson that seems to stand out in the treatment of pleurisy with sterile effusion is that open operations in this type of case are disastrous. This may be said in spite of certain unhappy results that may occur if fluid remains too long in the chest. There is danger of formation of adhesions with permanent fixation of the lung in an abnormal position with relation to the chest wall as well as of persistent re-accumulation of the effusion.

#### METHODS OF EXAMINING THE EXUDATE

In the present series of cases three types of examination were carried out. Two of the types do not afford immediate aid; it takes weeks to carry out guinea pig inoculation and pathological material can be examined only in the cases of the unfortunate patients whose first infection has become contaminated by various bacteria so that they not only have empyema but tuberculosis to contend with. The work of Musgrave, Duboff, Zebrowski, Vidal and Rivaut as well as many others would incline one to believe that many varieties of examinations may be necessary. In the order of importance the methods of value at our disposal are as follows:

1 *Ascertaining the character of the exudate*—Lymphocytes predominate in a large proportion of fluids resulting from primary pleurisy with serofibrinous effusion. This is not an infallible rule but is of value when positive. Sanguineous effusion is usually indicative of either tuberculosis or malignancy of the lung or pleura.

2 *The cultivation of bacilli*—A sterile fluid is suggestive of tuberculosis. In pneumococcal infections also the pneumococcus may have died out and the pus be sterile. The history and associated clinical examination can assist in the diagnosis. *Staphylococcus* is an unusual germ in empyema when it is

found; it suggests the presence of tuberculosis (Netter).

3 *The direct smear in the search for the bacillus of tuberculosis*—The examination may be negative on a number of occasions and yet be positive finally. In this respect examination of the direct smear is comparable to examination of sputum; it will reveal positive findings in only about 20 per cent of the tests.

4 *Inoscopic examination of Jousset*—By this laboratory procedure the clot formed is removed and digested after which the residue is incubated centrifuged and examined for the bacillus of tuberculosis. The technique is described by Musgrave.

5 *Zebrowski's sedimentation method*—Large amounts of fluid are used; coagulation is prevented by adding sodium fluoride and sediment is allowed to collect. By this method the bacillus of tuberculosis has been found in 55 per cent of primary and 83 per cent of secondary cases.

6 *Animal inoculation*—Variable results have been reported probably depending on the methods and amount of fluid employed. Thus Lord had 22.7 per cent positive results in sixty-six cases. Eichorst had 62 per cent positive but used 15 cubic centimeters of effusion for his inoculation and LeDamany had 85.4 per cent using 300 cubic centimeters of effusion for his inoculation but gave them in divided doses.

7 *Examination of pathological material*—These methods have been discussed earlier in the paper.

#### TREATMENT

This series of cases seems to show that patients who are treated conservatively at the beginning make the quickest and the most satisfactory recoveries. It is essential that they be treated for tuberculosis rather than for an infection in an organ and that ordinarily the ill effects of pressure be guarded against by sufficient but not dangerously frequent aspirations. When sepsis occurs however either from connection with the parenchyma of the lung and the bronchi or from without the situation is totally different and it is necessary to institute drainage. The surgeon must assist the inflammatory process by removing the debris that the body is unable

to care for. Thus the type of operation done for chronic empyema becomes necessary for tuberculous empyema.

### CONCLUSIONS

It would seem wise to regard all cases of serous effusion as tuberculous and to bear in mind that a great deal of harm can be done by hasty or ill considered treatment and that a large percentage of all cases of empyema especially if not preceded by pneumonia or sepsis are also tuberculous.

In planning method of treatment great care should be exercised in the preliminary evaluation of the history in the examination of the aspirated fluid and in the consideration of implications involved in cases of sterile exudate. Any lack of such care and consideration results in failure to conduct treatment intelligently and reduces the patient to a condition of chronic invalidism. Should the patient finally recover from the subsequent necessary operative procedures the end result although satisfactory is not a triumph but rather a test of his own vitality.

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ANEURISMS OF SCARPA'S TRIANGLE<sup>1</sup>

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IT is the aim of the authors in presenting the following discussion and report of cases to review some of the commonly known facts relative to aneurisms in this locality and to emphasize now and again certain phases of the work which we feel merit special consideration.

Probably no better example of the chaotic condition of our knowledge of blood vessel surgery is to be had than that expressed by LaRoque in the following extract taken from one of his recent articles (31):

Along with the lack of practice in the technique of suturing and tying large arteries and veins the surgeon when confronted by the management of such an injury feels also need for clear-cut authoritative information which will lead him to pursue exactly the proper course in dealing with these injuries often among the most dramatic situations in the practice of surgery. What to do, what not to do and when and how and why these are the questions. Disappointment is apt to follow expectation to secure the information necessary to a solution of the problems from a study of the clinical case reports in literature. The records of laboratory work fail to elicit the completely assembled practical instruction which one needs at his finger tips in clear cut formulated plans of procedure.

Aneurisms have been known to physicians since remote antiquity. Rufus of Ephesus and Galen described aneurisms of traumatic origin. Aetyllus described those of spontaneous origin and to William Hunter (22) probably belongs the credit of having first clearly described an arteriovenous aneurism. Notwithstanding our long acquaintance with these lesions we apparently have much to learn if we are to place the surgical care of these cases beyond the 'hit or miss' position which it now occupies.

Approximately 8 per cent of all aneurisms are those of the femoral artery (8). To bullet and stab wounds lues and surgical accidents can be attributed more than 90 per cent of all aneurisms.

The close relationship existing between the femoral artery and vein in Scarpa's triangle make for their simultaneous injury. Of our even traumatic aneurisms six (Cases 1, 2, 3, 4, 5, 6) were arteriovenous and all six were the result of bullet wounds. The other traumatic aneurism (No. 8) followed the surgical removal of an infected inguinal gland three and one half months previous to the appearance of the pulsating tumor at the site of the operation. It is possible that lues had a part in the etiology of this case since on examination it was found that the patient had a four plus Wassermann reaction. In our three spontaneous aneurisms (Cases 7, 9, 10) the Wassermann was positive in each case.

In no case did we have more than one diagnosed aneurism in the same individual although we had in mind the fact that two and even three of the femoral artery have been reported by Antonio Scarpa (35), Fleury (11) and others. In reviewing our cases one is at once impressed by the importance of bullet wound in the causation of vessel injuries in civil life and still more impressive is the fact that in every case of gunshot injury to blood vessels in this area an arteriovenous aneurism was produced.

## SYMPTOMATOLOGY

1. *Simple aneurisms or true aneurisms*—The tumor mass in these cases varies greatly and there is some question as to what extent a vessel may dilate before the wall of the aneurism ceases to be composed of the histological elements common to arteries. In one of our patients (Case 7) the tumor mass measured about 12 centimeters in diameter. The third one of our series presented a fusiform dilatation of the femoral about 8 centimeters long and 4 centimeters wide. The other patient (Case 10) was cognizant of a small almond sized mass on the inner side of the leg but attached little significance to its presence until he suddenly experienced a sharp pain in the tumor mass and was seized with a sense of faintness and dizziness. The thigh rapidly in-

creased in size until it measured half again that of the normal limb. The entire thigh became tense and edematous and showed a heaving expansile pulsation synchronous with the heart beat. In one patient in the group (Case 8) we were able to follow the development and changes in the aneurism during the course of a typical lobar pneumonia. During the illness the size of the aneurism increased by nearly one half. We feared that during one of his spasmodic coughing attacks a rupture of the sac wall would surely occur and so far as we knew nothing could be done to prevent such a calamity. We considered compression but felt that this would not be justified in the presence of his already embarrassed cardiac action. Fortunately he weathered the pneumonia and we were able to operate on him some time later with an excellent final result.

*Sensory and motor disturbances.* Pain was complained of by all four patients. The size of the aneurism seemed to have less to do with its severity than the location. When the nerves were compressed or stretched by the dilated sac symptoms were often marked. In two cases the patients thought the pain was rheumatic until the tumor mass was of considerable size.

Anesthesia was present over variable areas below the tumor masses. Pareis was present in Case 10 and he suffered such pain that it was impossible to persuade him to attempt any voluntary movement of the extremity. The degree of motor disturbance was hard to estimate. Marked weakness of the quadriceps femoris was present in Case 7.

*Venous obstruction.* In two of our series (Cases 9 and 10) there occurred marked edema of the lower leg due in the one patient (Case 10) to the spreading arterial hematoma causing compression of both the superficial and deep veins and in the other patient (Case 9) it resulted from lateral compression of the common femoral vein close to Poupert's ligament. The two remaining cases showed little interference with venous return flow.

*Murmurs.* Soft blowing murmurs systolic in time were present in 3 cases while in the arterial hematoma case the murmur was loud and somewhat resembled those heard in arteriovenous aneurisms.

*Thrills.* Only one of our patients (Case 6) presented a thrill on palpation. Reports indicate that thrills are not common except in arteriovenous aneurisms.

#### SPONTANEOUS RUPTURE

This complication occurred in only one of our cases (10). Where such a rupture occurs converting a true aneurism into an arterial hematoma or false aneurism it adds greatly to the likelihood of subsequent gangrene since the wide extravasation of blood not only produces pressure on the collateral lowers the blood pressure in the general circulation and in the artery peripheral to the rupture but the reaction in the tissues as a result of diffusion of the blood along the muscle and fascia planes offers a serious hindrance to the development of collateral circulation.

Makins (26) in discussing traumatic arterial hematomata says that the tissues surrounding these arterial hematomata react in a remarkable manner to the stimulus afforded by the presence of the blood clot in their midst. The connective tissue of the vascular cleft the intermuscular space and the muscles themselves become infiltrated with serum and an abundance of leucocytes destined to take part in the subsequent absorption of the clot. A considerable part of the mass of the tumor in the early stages consists of this surrounding infiltration and the gradual disappearance of the latter and of the edema accounts for much of the diminution in the apparent size of the tumor.

#### ARTERIOVENOUS ANEURISMS

The recent contributions to the literature of this singular lesion by Halstead (20) Gesner (13) Callander (4) Reid (34) Holman (23, 26) and Hoover and Beams (23) has stimulated a renewed interest in this type of aneurism. In this presentation we shall not attempt to discuss the interesting phases of pathological physiology presented by these cases. We propose to confine ourselves to the clinical aspect as closely as possible. Various types of arteriovenous aneurisms are described. The simplest form is the aneurismal varix in which the opening in the artery is in direct apposition to the opening in the vein. Makins

recognizes six types depending upon the arrangement of the aneurismal sac

The vein is generally described as playing a secondary part although it may furnish the major portion of the tumor mass

#### DEVELOPMENT OF ARTERIOVENOUS ANEURISMS

This type of aneurism is often not recognized for some considerable period after the initial injury. This period of latency in diagnosis may have two explanations first an interposed hematoma formed at the time of the injury may delay the formation of the fistula until shrinkage or absorption of the clot allows the vessels to communicate second the communication which may be comparatively small at first may enlarge and the bruit and thrill make their appearance some time after the injury. One of the patients (Case 2) was shot in 1912 and it was not until 1917 that the swelling of his leg pulsation and accompanying pain were marked enough to cause him to seek surgical aid. His condition gradually grew worse and he entered the Cook County Hospital in 1923 11 years after the initial injury

#### SACS OR TUMOR MASSES

The tumor masses in arteriovenous aneurisms rarely reach as large a size as those seen in simple aneurisms although dilatation of the vein and its tributaries may produce a mass of some considerable size. In one of our patients (Case 5) there were large nodular varicosities extending well over the symphysis pubis toward the umbilicus. In Case 2 the involved leg showed marked varicosities and a varicose ulcer was present over the anterior aspect of the lower leg. The varicosities had been operated upon by a surgeon in an attempt to cure the ulcer some time previous to his admission to our service

#### SIGNS OF ARTERIOVENOUS ANEURISM

**Murmur** The murmur has been variously described as machine like rumbling whistling or like a millrace. It lasts throughout the cardiac cycle being loudest during systole. As the condition progresses or recedes the murmur may change in character. It is interesting to note that the murmur can often be heard with the ear several inches from the

skin surface. Makins (26) emphasizes the fact that the height of pitch of the murmur is a valuable guide to the exact site of the fistula. It is highest and loudest immediately over the communication. A further interesting phenomenon in connection with the murmur is its transmission along the course of the large vessel both centrally and peripherally. In one of our patients (Case 2) it could be heard distinctly over the internal malleolus and centrally could be traced to the epigastric region.

**Thrills** The thrill like the murmur is continuous throughout the cardiac cycle and most marked during systole. It is described as purring or bubbling in character. Holman (18, 19) believes it to be due to the vibration of the proximal septum between the artery and vein which is set in motion by the swirling eddying stream of blood as it rushes from the artery with its high pressure to the vein with its lower pressure. Holman also states that the intensity of the thrill may serve as a guide to the volume of blood flowing through the fistula. The thrill may be palpated at some distance from the site of injury. Both murmur and thrill were most marked in the case which had existed 11 years the least marked in a recent case of aneurismal varix.

**Venous pulsation** In none of our cases could there be seen definite venous pulsations. Such pulsations are more common in arteriovenous lesions in the neck. The distention of the superficial veins imposed as they often are upon the dilated artery and deeper vein coupled with the marked arterial pulsation may give one the impression of pulsating veins.

**Venous stasis** More or less œdema was present in every case. It varied in degree from faintly discernible pitting on pressure to the extreme congestion, varicosities and œdema found in Case 2.

**General circulatory derangements and heart conditions** Attention has been repeatedly called to the presence of murmurs at the base of the heart in cases of arteriovenous aneurism. We have been unable to verify this finding in our cases although we have sought the co-operation of the internist on several occasions. Several of our cases showed increased size of



heart and one (Case 6) showed an enlargement of the liver to about three fingers breadth below the costal margin. After operation the heart dulness receded and the liver returned to normal size. Electrocardiographic tracings in one case showed no change from normal. We made X-ray examinations of the base of the heart and aortic region in two cases, neither of which showed any widening or change of note.

**Pulse rate.** As a rule the pulse rate is fairly rapid in these cases, ranging around 90 to 100. Branham (3) in 1890 called attention to the marked slowing of the pulse when an arteriovenous fistula was compressed. In some instances the pulse rate will be decreased by half. This decrease in pulse rate is not a permanent affair, but tends to disappear when pressure is released or the fistula is permanently occluded by operation. In one of our cases the pulse rate increased on compression of the fistula area, and in another the rate decreased from 82 to 76. We believe that the extent of the collateral circulation may be a factor in lessening the reaction to the closure of the fistula.

**Blood pressure.** There is usually some increase in the systolic blood pressure and a lowering in the diastolic pressure when an arteriovenous aneurism has been produced. It is interesting to note that the blood pressure and pulse rate are both affected by closure of the arteriovenous fistula. Immediately after the closure there occurs a decided increase in both systolic and diastolic pressure. Some considerable time after the operative closure of the fistula the systolic pressure usually returns to near normal, or at least to the pre-operative level, while the diastolic usually maintains a slightly higher level than was present before operation. Thus we have observed in several cases.

#### DIAGNOSIS

The direct diagnosis of typical simple or arteriovenous aneurisms presents little difficulty. However, in certain instances serious results have followed errors in interpreting the causation of certain tumor masses in or near the groin.

Cayley (5) reports an aneurism of the left femoral which became converted into a large abscess. In our series Case 10 was being

treated by hot fomentations with a view to incision when a fluctuating area developed. The condition had not been diagnosed up to the time he came to our service.

Case (12) reports a femoral aneurism which so closely imitated a femoral hernia that he was in doubt of the diagnosis for some time. Gibb (15) gives an account of a femoral aneurism which was incorrectly diagnosed a malignant tumor. Tutin (16) speaks of a case from Langenbeck's clinic where a femoral aneurism eroded the horizontal ramus of the pubis and the hip joint and the diagnosis was extremely difficult.

An arteriovenous aneurism is often overlooked because of the mildness of its symptoms and the unobtrusiveness of its signs. The characteristic murmur and thrill if once heard usually serve as reliable guides to a correct diagnosis.

#### INDICATIONS FOR OPERATION

Experimentally it has been shown that the fistulous communication in arteriovenous aneurisms may close spontaneously. However, we doubt if we are ever justified in treating either spontaneous or traumatic aneurisms expectantly.

Threatening rupture, external hemorrhage, subcutaneous hematoma formation, or rapid increase in size are indications for immediate operation.

Cardiac embarrassment and extensive aneurismal dilatation call for early treatment in arteriovenous aneurisms.

The advisability of awaiting collateral circulation development in traumatic cases is to our mind a waste of time in aneurism of the femoral in the groin. In the Matsa Clinic they use the Malschuetts Central compressor to encourage the development of collateral circulation. Many ingenious devices and interpretative tests have been applied with the hope of eliciting the amount of collateral circulation and a very thorough review of this phase of the work is to be found in an article by Matsa (17) in *New Orleans* published in 1914.

#### PRE-OPERATIVE MANAGEMENT

When ligation is present in either type of aneurism a thorough treatment with mercury

and potassium iodide should be immediately instituted and resumed as soon as possible after operation

Cases showing cardiac embarrassment marked oedema or extreme varicosities should have the benefit of rest in bed for a reasonable period previous to operation

#### NON OPERATIVE TREATMENT OF SPONTANEOUS ANEURISMS

We think that we may pass as incidental the reports of cases of peripheral aneurisms treated by application of ice (16) administration of veratrum viride (1) ergotin (32) gelatine and similar procedures

The use of compression either by instruments of the type of Reid's pelvic instrument Carter's elastic band by compressors of the type of that commonly designated as the Massachusetts General Hospital compressor or by digital pressure has some very staunch advocates Delbet (10) reports 111 cases of aneurisms treated by digital compression of which 76 were cured (68.5 per cent) Vialle (36) Colle (30) and Holt (21) report cures from this same method Lawson (24) reports a case of femoral aneurism treated by pressure on the abdominal aorta While there may be cases in which these methods are indicated they undoubtedly make up a very small percentage

#### OPERATIVE TREATMENT

It is difficult to lay down any hard and fast rules in the treatment of aneurisms in general but we believe we can formulate a fairly reliable working plan for aneurisms of the femoral artery in Scarpa's triangle

To avoid confusion let us discuss the treatment under the following headings

- 1 Provisional control of vessels proximal and distal to the aneurism
- 2 Exposure of the sac in spontaneous simple aneurisms or of the fistula in arteriovenous aneurisms
- 3 Management of the sac

*Provisional control of vessels* If the aneurism is high up in the common femoral close to Poupart's ligament it has been our practice to proceed as in the usual manner for extraperitoneal ligation of the external iliac except

that instead of catgut or silk we have used a wide flat silk obstetrical tape passed separately beneath the artery and vein and held as slings We have found this procedure so easy and so satisfactory that we have used the rather high control where we might have used an incision along the artery below Poupart's ligament It has been found in our work that slight angulation of the vessel with the forefinger compressing the vessel wall will readily control the femoral artery and vein from above Gibbon (14) has recently urged that the circulation should be controlled by digital compression because the use of clamps or ligatures may cause the subsequent development of an aneurism at the site of their application We are however not ready to dispense with our proximal tape sling

When the aneurism is far enough below Poupart to insure ready access to the femoral vessels without fear of encountering the sac we place our tapes in this region In spontaneous aneurisms and in arterial hamatomata it must be remembered that the vessels are often diseased or surrounded by inflammatory tissue for some distance proximal to the sac and the application of ligatures or clamps is a task In such cases it is sometimes easier and safer to use the approach suggested for lesions close to Poupart's In the majority of cases we have found it unnecessary to place provisional ligatures or slings below the aneurism site

*Exposure of the aneurism* After having applied our provisional controls we begin our incision below the aneurismal sac and dissect carefully toward its most prominent area In two of our cases it was necessary to connect the oblique incision above Poupart's ligament with the longitudinal incision along the course of the vessel In these incisions we severed Poupart's ligament directly over the artery and vein thereby giving us complete exposure of the femoral artery and about one and one half inches of the external iliac

*Management of sac* In spontaneous aneurisms we resorted to quadruple ligation in every instance In three of the cases we excised the sac and ligated or sutured the bleeding areas We quite agree with Gibbon (14) that one of the most important measures to take in order

to avoid infection is complete hæmorrhage. However we do not completely subscribe to his fear of small gutta percha drains placed in the wounds to allow exudum or light oozing of blood to find a ready exit along their tract. We have repeatedly used such small strips and so far have had no regrets. In one spontaneous aneurism near the apex of Scarpa's triangle we made use of the obliterative type of endoaneurismorrhaphy suggested by Mats (1).

In arteriovenous aneurisms we performed quadruple ligation in each instance. In 4 of the 6 cases we excised the sac and the fistulous communication. In two instances we obliterated the artery and vein between the ligatures by running sutures of catgut. In both of these cases there were large varicosities extending over the region so that excision seemed less vital than suturing.

#### DISCUSSION

Speaking before this society it would seem thoughtless not to mention some of the ingenious and surgically artistic repairs which have been accomplished in arteriovenous aneurisms. To the late Dr. Murphy belongs the credit of having successfully done an anastomosis of the femoral artery and lateral repair of the femoral vein in an arteriovenous aneurism of Scarpa's triangle. Mention should also be made of the works of A. E. Hulst and Carl Beck. Innumerable cases have been reported of anastomosis of both vein and artery of each with repair or obliteration of its fellow or of repair of lateral rents in each. The Matas-Bickham operation has some features of interest but it is probably better suited to other localities than to the area under discussion.

#### POSTOPERATIVE TREATMENT

Luetic treatment should be resumed in cases showing a positive Wassermann or clinical lues.

No plints or pads should be applied to the leg.

The leg should be depressed rather than elevated as has been suggested in most instances. The patient should be encouraged to begin immediately active movement of the toes and ankle and his position should be changed frequently so that no prominence is

subjected to pressure for any considerable period of time.

A therapeutic light arranged under a blanket tent will supply heat to the entire extremity.

Dressing should be kept clean and free from moisture. The small gutta percha drains are removed within twenty-four hours.

#### CONCLUSIONS

1. Aneurism of Scarpa's triangle are comparatively common.

2. Arteriovenous aneurism outnumber the simple variety.

3. Trauma and lues are the important etiological factors.

4. In most cases provisional ligation of artery and vein followed by permanent quadruple ligation with excision or plication of sac will produce excellent results.

#### REFERENCES

CASE 1. White male age 63 yrs Cook County Hospital Case No 778141 was admitted hospital November 1, 1921 and he was discharged December 18, 1921. Patient had a gunshot wound about 8 inches below upper ligament followed by an arteriovenous aneurism. At operation was applied for hæmorrhage. Quadruple ligation and excision of the sac and fistulous area in artery and vein were done. No drainage. There was no infection and the wound healed rapidly. Patient had no complaints and walked without limp on leaving hospital.

CASE 2. Negro male age 27 years Cook County Hospital Case No 849901 was admitted August 23, 1921. Operation was done August 18, 1921 and he was discharged September 21, 1921. Patient had a bullet wound of thigh in 1912. Varicosities and pain were most marked in last 4 years. An arteriovenous aneurism developed. Extraperitoneal provisional ligation of external iliac artery and vein was done and quadruple ligation and endoaneurismorrhaphy were later performed. Two small gutta percha drains were inserted. The wound healed without infection. The patient showed great improvement before leaving hospital. He had an ulcer of leg which had practically healed. The edema of leg greatly diminished after operation.

CASE 3. Negro male age 35 years Cook County Hospital Case No 85489 was admitted September 21, 1921. Operation was done September 2, 1921. He had an arteriovenous aneurism of the femoral artery in the inguinal fold which was produced by a bullet wound inflicted 12 days before admission to hospital. Hematocele was present in left side of the scrotum. Extraperitoneal provisional ligation was followed by permanent ligation. Ligation

were placed on artery and vein just below the fistula. Partial excision of sac and fistulous communication was done. Guttapercha drains were inserted and removed in 24 hours. Patient made excellent recovery and was discharged from hospital October 25, 1923.

CASE 4. White male age 14 years admitted to Cook County Hospital No. 859069 November 13, 1923. He had a bullet wound in the middle of the right thigh with arteriovenous aneurism of femoral artery. The wound was infected and exuded a purulent material on pressure. A tourniquet was applied and incision was made along the femoral artery, exposing an arteriovenous aneurism. Quadruple ligation with excision of sac was done. The spread of infection and a beginning gangrene made amputation necessary 8 days after admission. Patient was discharged March 11, 1924.

CASE 5. Negro male age 18 years admitted to Cook County Hospital No. 866730 January 14, 1924. Operation was done February 21, 1924. Patient had an arteriovenous aneurism of femoral artery produced by a bullet wound which was received one hour before admission to hospital. Aneurism was found 1 inch below Poupart's ligament. Extra-peritoneal provisional ligations of external iliac artery and vein were later made permanent ligatures. Ligatures were placed on artery and vein below aneurismal sac. Excision of part of sac and closure of collaterals by catgut suture were done. One forceps was left on small collateral because of friability of structures about artery. A small gauze pack was inserted in wound. Artery forceps were removed in 6 hours. He had a slight infection which cleared up in one week. Patient was discharged February 5, 1924. He walks without limp. Patient has since returned for examination and is working regularly and has no trouble with leg.

CASE 6. Negro male age 20 years was admitted to Cook County Hospital Case No. 890902 July 24, 1924. Eight weeks before admission patient was shot in upper right thigh. Pains and pulsation made him so uncomfortable that he sought relief. We found an arteriovenous aneurism of the right femoral about 8 inches below Poupart's ligament. Provisional ligatures were applied to the external iliac artery and vein by extraperitoneal approach. Quadruple ligation of femoral artery and vein followed by obliteration of sac and fistula by obliteration aneurismorrhaphy. Patient was discharged September 15, 1924. He is now working on express delivery and gets about with out limp or inconvenience of any sort.

CASE 7. Negro male age 47 years was admitted to Cook County Hospital Case No. 82163 December 17, 1922. A tumor mass with pulsation had gradually developed in the right groin for last 2 months. Pain and difficulty in movement caused patient to enter hospital. Wassermann reaction was positive. Extraperitoneal provisional ligatures of external iliac artery and vein were applied and later made permanent ligatures. Ligation of artery and vein below area of aneurism. Aneurismal sac was

dissected out. Incisions were closed with black waxed silk. There was a very small amount of oozing from the wound. Patient was discharged from hospital January 6, 1923. He has been seen many times since he left hospital. He has never completely regained motor function of the quadriceps femoris. He walks with slight limp. Circulation in limb is good.

CASE 8. Negro male age 31 years was admitted to Cook County Hospital November 8, 1923. Case No. 859373. Nine months previous to admission patient developed inguinal bubo which was later partially excised. About 1 month previous to admission a tumor mass appeared at the site of the operation scar. The mass was tender and was the cause of hip rubbing pains which became so annoying that the patient sought relief. Wassermann as positive. Some areas of induration in right thigh below tumor mass were found to be lymphatic adenitis. Operation patient enjoyed. Bilateral pneumonia. He was operated on November 6, 1923. Extraperitoneal ligation of iliac artery and vein was done. Ligation of artery and vein below aneurism. The sac was ligated out, the bleeding points ligated or sutured, and gauze drain inserted because of large dead space which was too friable to close with sutures. All of brain matter moved 10 days later. No infection occurred. Patient has been seen many times since the operation. He is now a chauffeur and uses his leg all day. Living. He was discharged from the hospital December 13, 1923.

CASE 9. Negro male age 32 years was admitted to Cook County Hospital Case No. 876217 March 6, 1924. Six months previous to admission pulsation of jumping nature was present in right thigh. A tumor mass appeared in apex of Scarpa's triangle. Pain was so severe that the patient could not sleep. The right knee was swollen. Aneurism was fusiform in outline. Wassermann was positive. Operation was done on March 28, 1924. An incision was made over the femoral artery and vein above aneurism and provisional ligatures were placed. The sac was exposed. Provisional ligatures were made permanent and artery and vein ligated below sac. The sac was obliterated by aneurismorrhaphy. Patient was discharged from hospital on April 21, 1923, with leg in excellent condition and apparently no lack of collateral circulation.

CASE 10. Negro male age 38 years was admitted to Post Graduate Hospital February 26, 1920. Ten days previous to admission he discovered a small painful pulsating tumor mass in right thigh. Tumor mass enlarged to the size of a golf ball and on the tenth day ruptured. Thigh became quickly distended with blood and a heaving expansile pulsation was present. Thigh measured 32 inches in circumference while normal side measured 22 inches. Pain was excruciating and motor power of leg was practically nil. Wassermann was positive. Operation February 28, 1920. Provisional extraperitoneal ligation of external iliac artery and vein. An incision was made over the femoral artery and the sac ex-





by tissue examination. One reoperation was for bilateral laceration and 1 for laceration and erosion with leucorrhœa. These 2 cases would now be treated by cautery. In 2 cases there was pain in the side without apparent cause and in 1 case a tender mass in one for nix.

In two cases retroversion followed myomectomy. One of these patients complained of pain and frequent micturition and the other of sterility.

One patient was re-admitted to the medical wards for chronic endocarditis.

Another was re-admitted and operated upon for adhesions of the peritoneum.

The final faulty result was in a patient who complained of frequent urination.

In 3 cases full term pregnancies followed myomectomy.

In considering the problem of whether an ovary should be left when hysterectomy is performed we analyzed 124 cases in which one or both ovaries were left. In 8 of these cases the remaining ovary was enlarged. Two of the ovaries had developed into good sized permanent painless cysts 4 to 6 inches in diameter. Two others were smaller but painful. Four of the enlargements disappeared in less than 6 months. In three cases the opportunity was presented at reoperation to examine the remaining ovaries. In each case they were firmly bound down by adhesions. This would suggest that difficulty may be experienced in removing a cystic ovary which has been left after hysterectomy, a feature which we have observed in other cases not in this series.

In a study made at the end of the first 5 years it was found that the surgical menopause was delayed and was less severe in cases in which ovaries were left. The results were best when the tube was left with the ovary.<sup>1</sup>

The symptoms of surgical menopause usually occurred within 3 months. The incidence and severity of the symptoms are indicated in the following table.

Cases examined at 3 months					Symptoms of menopause				
					Cases	Cases	Pct		
Psychic	Out	18	7	39	S	r	n	6	
On	ovary	4	7	7	Se	er	in		
B	thoracic	2	1		N	t	s	ere	
H	wk	E	M	Am	J	Obst.	&	Gy	rec
					9		Jun		

The cervix was left in 159 cases. In no case did cancer develop in cervix. It was removed once when cancer was suspected but it was negative. Twice the remaining cervix was removed because of old laceration. One of the 2 cases had a persistent profuse leucorrhœa from erosion.

In most of the cases the cervix became smaller. Whether this atrophy was due to shrinkage following reaming out of the canal or to interference with blood supply is uncertain.

There was no case of prolapse of the cervix. Since the round ligaments were not sewed into the cervical stump in about one third of the cases it is evident that this procedure is ordinarily unnecessary as a means of support for the pelvic floor. There is nothing cut which supports the cervix when a supravaginal hysterectomy is done, therefore if the cervix is in good position it is likely to remain in good position. As Bissell states tension by the round ligaments tends to draw the cervix toward the introitus of the vagina an unfavorable position. Further sewing the ligaments under tension into the cervical stump occasionally causes pain. Therefore as a routine step it appears to us best not to suture the round ligaments under tension into the cervical stump with the object of thus supporting the pelvic floor. They may however be used to advantage without tension as an aid in peritonealization.

In most of the cases the cervical stump was reamed out from above. This procedure does not remove the epithelium about the external os which is the most common origin of carcinoma of the cervix. The reaming process simply removes part of the mucous membrane of the cervical canal. Its effect then is not so much to prevent malignancy as to afford easy approximation of the edges and to prevent excessive leucorrhœa in an infested cervical canal by removing a large proportion of the glands of the cervix. While we have seen two cases (not in this series) of cancer in a cervical stump the occurrence is very infrequent and should not be the deciding argument for complete hysterectomy. Of course it must be recognized that some cases of extreme laceration indicate complete hysterectomy but

these are rare. In doubtful cases the cervix may if necessary be subsequently removed from below or treated with cautery. This seems in general a safer and safer procedure than a complete hysterectomy. The attachments of the cardinal ligaments at the side of the cervix are thus left intact. In this way prolapse of the vaginal walls which sometimes follows complete hysterectomy is avoided. We have had no case of hemorrhage from the cervical stump.

**Conclusions.** For fibromyoma the following procedures are apparently indicated: 1. X-ray treatment according to the rule of Clark of Philadelphia. 2. Myomectomy in young women when feasible. 3. In general supra vaginal rather than complete hysterectomy. 4. Round ligaments ordinarily should not be attached to cervix under tension. 5. One or both ovaries should be left preferably with their tubes.

# CARCINOMA OF UTERUS

There were 45 cases of carcinoma of the uterus.

Five of the patients with cancer of the cervix were between 20 and 30 years of age; 15 between 30 and 40 years. This is a significant proportion of cases in young women. Five patients with cancer of the cervix had not borne children, thus eliminating laceration in these as an etiological factor. Radical abdominal hysterectomy was performed in 16 cases and vaginal in one with 2 deaths; 12 were favorable cases. There were uterine fistulae in 2 cases and vesical fistulae in 2. Three of the 4 fistulae closed spontaneously. There were 4 infections. These results constitute a rather appalling reflection upon the radical operation or upon the way it was performed.

Of the 15 survivors of radical operation 8 are known to have died of the disease in 3 years; the result is uncertain in the patients being lost in 4. The result was good in 1; three patients who had squamous celled carcinoma of cervix have passed 8 years, 7 years and 4 years respectively without evidence of recurrence. One patient with cancer of the body of the uterus died of nephritis 4½ years after operation and autopsy showed no recurrence or metastases. None of these long standing cases

had irradiation. With cautery methods nothing seems to have been accomplished (13 cases).

**Follow up.** Operative treatment was carried out in 11 cases of carcinoma of the cervix. The results are as follows: 1 postoperative death; 5 died within 1 year; 1 died within 3 years; 6 cases had no recurrence when last seen 15 months, 3 years, 6 months, 2 years, 6 months, 4 years, 3 months, 7 years and 8 years after operation. Operation for carcinoma of the body of the uterus was done in 4 cases with 1 postoperative death; 1 death in 5 months; 1 death from nephritis in 4 years, 7 months after operation but no recurrence and 1 patient alive with no recurrence 1 year after operation.

No operation was performed or treatment given in 3 advanced cases and the patients died in 5, 6 and 7 months respectively.

The Laquein cautery were used in 4 cases with 1 operative death from peritonitis and death in 3 cases in 2½ months on an average. The Icery cautery was used in 3 cases and the patients died in an average 6¾ months. The Icery cautery was used and the iliac ligament in 3 cases with 1 operative death from shock and 2 deaths in an average of 9 months.

Radium alone was used in 4 cases and the patients lived from 5 to 18 months.

Radium and X-ray were used in 8 cases. Five patients died in 6 to 18 months and 3 were living when last seen 10 to 12 months after operation. The radium was administered in another clinic.

**Conclusions.** The analysis of our operative results and the observation of the results of radium treatment in the hands of others has led us in recent years to advise radium rather than operation for carcinoma of the cervix except in very early cases a type unfortunately which we rarely see.

The limitations and shortcomings of a follow up system are strikingly exemplified in this cancer series. Whereas practically all of the cases were followed for a variable time, most of the important ones were lost during the progress of years and of course in cancer it is only the long extended follow up that counts. A special effort must be made to hold such cancer cases under observation, one





operation. If the pessary has given relief the cases have been referred for surgical treatment in the expectation that they might receive permanent benefit. In the second year the result have improved so that in 51 cases followed 48 have been anatomically good 94 per cent and 36 symptomatically good 70 per cent. The Gilliam operation was done in 36 cases of the 38 cases.

### SALPINGITIS (CHRONIC)

There were 5 cases of salpingitis with no operation done in 30 cases leaving 19 in which laparotomies were done (cases of colpotosomy for abscess are not included). In these a longitudinal incision was used in 164 cases the transverse in 31.

All of the operative procedures will not be enumerated in detail. The groups were in general as follows:

Hyst rect my (n 6 b th	ies m et)	C	ve
Salpingo-oophorectomy on	es l w th alpngec	4	
omy n the sid		53	
Bilateral salpingct my both o	res l ft	3	
Bilateral alpg o-phor t my		0	
Lateral salpingo-oophorectomy		3	
Lateral alpi ectomy		0	
Cervati e peraton		8	
Ln l s f d		0	

Unfortunately it is not possible in this paper to discuss the etiological factors nor the type and degree of infection.

**Immediate results.** There were 5 deaths in the hospital. The first patient died from peritonitis following salpingo-oophorectomy, the second patient died of peritonitis following supravaginal hysterectomy and bilateral salpingo-oophorectomy, a third patient died of peritonitis following bilateral salpingectomy for large abscess, the fourth and fifth patients died of pneumonia following supravaginal hysterectomy and bilateral salpingo-oophorectomy. There was a mortality of per cent (3 of the deaths were in 14 hysterectomies).

**Follow up.** Of 161 cases examined 127 were judged to be in entirely good condition (79 per cent) leaving 34 cases judged to be in faulty condition. Of these we will cite only the more important groups, namely 7 incisional hernias, 10 cystic ovaries, 5 cases had severe symptoms of surgical menopause, 3



Fg Phot mic g aph ho m, emb y l type f  
lls h h som pects re emble endoth l m

cases of adherent retroverted uterus, 2 cases complained of pain in pelvis.

There were 14 subsequent operations, five of these for bleeding. It is worthy of note that 3 patients became pregnant, 2 going to full term, 1 aborting.

The high mortality following hysterectomy, 3 in 14 cases, indicates the danger of such a radical procedure.

The fact that there were only 10 cystic ovaries in the large number left indicates that there is little risk of trouble from conservatism, but 5 cases of severe surgical menopause in 16 bilateral oophorectomies is a serious reflection on this radical procedure.

The follow up shows few cases of trouble from leaving the uterus. Five patients required treatment for bleeding and 3 were found to have adherent retroverted uteri.

**Subsequent operations.** 1. Hysterectomy for bleeding 3 years after double salpingectomy.

Hysterectomy for bleeding, fibrous uterus 4 years after bilateral salpingo-oophorectomy.

3. Removal of cystic ovary, difficult 4 years after repair of fecal fistula.

4 Repair of incisional hernia 4 years after operation

5 Repair of incisional hernia 5 years after operation

6 Dilatation and curettage for bleeding with X ray treatment later and also operation for cystic ovary

7 Dilatation and curettage for bleeding and X ray treatment

8 Operation for chronic intestinal obstruction and removal of cystic ovary

9 Radium treatment of carcinoma of cervix no operation

10 Repair of incisional hernia

11 Re operation upon cystic ovary

12 Operation for acute intestinal obstruction

13 Hysterectomy for fibrous uterus and bleeding 4 years after bilateral salpingo-oophorectomy

14 Operation for intestinal adhesions 2 years after salpingectomy

#### SALPINGITIS (ACUTE)

There were 87 cases designated as discharge acute salpingitis. They presented on admission acute symptoms notably fever pain and tenderness. They include not only early infections but also chronic cases with exacerbation (the latter were in the majority). Twenty-one cases were not operated on (7 refused operation and in 14 operation was not advised).

Laparotomy was done in 63 cases in this group. The longitudinal incision was used in 38 cases the transverse in 5. The following operation were done

Hist rect m	1
Bilateral salpingectomy and bilateral oophorectomy	0
Single salpingo-oophorectomy	7
Bilateral salpingectomy	6
Single salpingectomy	3
Bilateral salpingo-oophorectomy	8
Salpingo-oophorectomy and resection of fallopian tube	
Bilateral salpingectomy and resection of one ovary	
Bilateral salpingectomy and resection of both ovaries	
Laparotomy—drainage of abscess	1
Laparotomy—nothing removed from pelvis—appendectomy	8
Laparotomy—nothing removed	2
Bilateral salpingectomy and single oophorectomy the ovary resected	
Post-operative laparotomy	

#### Other procedures

Appendectomy	1
Vaginal suspension	36
Miscarotomy	6
Dilatation and curettage	2
	5

Abdominal drainage was used in 32 cases—in 13 extraperitoneal of the wound in 19 extraperitoneal. Vaginal drainage was used in 22 cases.

**Immediate results.** One patient died a mortality of 1.5 per cent. Death was from pulmonary embolism. Two patients had ileus. Both recovered. A high jejunostomy was done in one case. Three patients had pelvic abscesses.

**Follow up.** Of the operative cases 48 were examined. Of these thirty-seven were judged to be entirely good and ten faulty. There were really 11 faulty cases (judgment in 1 case was deferred). These 11 cases include 5 incisional hernias, cystic ovaries, adherent retroverted uterus, 1 atresia of vagina due to posterior colpotomy, drain 1 case of pain in pelvis.

**Conclusions.** From the combined groups acute and chronic salpingitis the following conclusions may be drawn.

1 Hysterectomy gives a relatively high mortality. This radical procedure should therefore in general be avoided.

2 Preservation of the uterus rarely causes symptoms; thus 5 cases only suffered from bleeding and 4 from adherent retroverted uterus.

3 The follow up analysis of the series of cases of acute and chronic salpingitis shows only 1 cystic ovaries in the large number of ovaries that were left.

This indicates that conservation of ovaries rarely occasions trouble. On the other hand there were 5 cases of severe surgical menopause in 17 cases in which both ovaries were removed (this included 6 hysterectomies). It is therefore important that one or both ovaries be conserved.

4 Careful follow up should lead to the recognition of complications at an early date.

#### TUBERCULOUS SALPINGITIS

There were 19 cases of tuberculous salpingitis.

In 7 cases 1 tube was removed in 11 both tube The appendix was removed in course of operation in 7 cases

The operator realized that he was dealing with a tuberculous lesion in only 7 cases This undoubtedly accounts for the preservation of one tube in some of the cases One case was treated by panhysterectomy and died on fifth day

#### Follow up

1 m followed
1 case 5 y rs
1 case 3 y rs 2 mo th
1 case 2 y rs 6 months
1 case 3 y rs 4 m nths
1 case 3 y rs m nths
1 case 2 y a 3 months
1 case 2 m ths
1 case 0 m nths
1 case 9 m ths
3 cases 16 m nths
1 case 3 m ths
1 case 1 m th
1 case 7 m nths
1 case 6 m nths
1 case 5 m ths

In 11 patients the result is entirely good to date in 6 it is faulty Of the 6 faulty cases developed tuberculosis of the urinary tract 1 had nephrectomy at 5 years 3 cases died of tuberculosis of lungs or elsewhere in an average of about 18 months after operation in 1 there was a persistent abdominal sinus

**Conclusions** 1 If left these cases would presumably develop into generalized tuberculous peritonitis

2 Early removal of affected tube seems to promise well for the limitation of the local process although it is obvious that our cases have not been followed sufficiently long to carry much weight as to the ultimate outcome

3 There is no reason to believe that the tuberculous process begins simultaneously in both tubes but certainly there is a tendency for both tubes to become involved therefore while it is not mandatory to remove the apparently unaffected tube it is probably safer to do so although all features of the case must be weighed carefully in the decision

#### ECTOPIC GESTATION

There were 93 cases of ectopic gestation Of these 4 were operated upon the second time for ectopic gestation in the remaining

tube making a total of 89 patients in the series

On admission to the hospital 4 cases were in collapse and 69 were in good or fair condition After operation transfusions were carried out in cases infusions in 16 cases and hypodermoclyses in cases

Diagnosis was correct in 68 per cent of the total number of cases correct in 100 per cent of cases in collapse Errors of diagnosis are shown in the following table which gives the number of times that ectopic gestation was diagnosed as some other lesion and also the various conditions that were wrongly diagnosed as ectopic gestation

In a total of 93 cases ectopic gestation was wrongly diagnosed as

	Time
Salpingitis tubal abscess	10
Pelvic abscess	3
Ovarian cyst	3
Incomplete abortion	3
Appendicitis	5
Fibroid	3
Cervical polyp	

Other conditions wrongly diagnosed as ectopic gestation

	Case	Time
Salpingitis tubal abscess	62	
Pelvic abscess	37	2
Ovarian cyst (tumour)	10	5
Incomplete abortion	48	2
Uterine gestation (placental)		

Ninety three laparotomies for ectopic gestation were done in 89 patients with 2 deaths one in a patient in collapse and the other of peritonitis in a patient with an old infected ectopic sac

**Follow up** Of 87 patients 7 were examined and 9 others were heard from through letters or the Social Service making a total of 94 (94 per cent) followed and 6 lost Four patients had a second ectopic gestation Ten patients have had normal pregnancies

1 postoperative hernia followed infection in 1 case

The results were all good except in 2 cases In 1 the result was fair with a mass in the pelvis in the other the patient had a hernia from a grade A infection

**Conclusions** In ectopic gestation when the patient is in collapse it has always been our practice to operate as soon as possible after

admission to hospital rather than delay as has been advocated by some. Morphine is administered. Fluid is withheld until the abdomen has been opened and hemorrhage controlled. The low mortality in 4 cases indicates that this should be the procedure of choice that is active hemorrhage should be arrested with the least possible delay.

### OVARIAN CYSTS AND TUMORS<sup>1</sup>

There were 250 cases of ovarian cyst and tumor. In 133 the ovarian condition was the dominant lesion. In 97 it was an associated condition as a rule a follicular cyst.

The 133 cases were classified as follows:

Follicular cyst	
Ovarian tumors and cysts	
Simple follicular cysts (simple follicular)	5
Corpus luteum cyst	4
Cystadenoma	
Pedunculated	
Fringed (mammillary type)	
Inert (papillary rare)	3
Serous	
Everted (rare)	
Intergluteal (common)	
With true papillary	6
Simple follicular papilloma	
With connective tissue excrescence	6
Cysts (if ovaries are so named) strangulated	3
perforated	3
Carcinoma	
Papillary cystadenocarcinoma	3
Carcinoma of the ovary	
Embryonal carcinoma (all colorectal rare)	
Primary follicular carcinoma	
Melancholic carcinoma	
Dermoid (squamous) carcinoma	
On case of diagnosis by operation	9
Teratoid tumors	
Dermoid cyst	
Teratoma	3
Fibroma	

The simple cyst were the most numerous. Some of the cysts were large and apparently important growths. They often had an epithelial lining of non-ciliated flat or cuboidal cells. They were rated nevertheless as simple cysts. Their histogenesis however is disputed.

The simple cysts also comprised almost the whole group of tumors associated with more

important lesions. They furnish evidence as to the outcome in resection of the ovary. Forty-eight cases with a resected ovary were followed. In 40 cases the result was good. In 8 cases the resected ovary was temporarily enlarged. In one case re-operation was done for a painful cyst.

The parovarian cyst were not noteworthy. Four were followed. Results good.

Of the pseudomucinous cyst 11 were unilateral and 2 bilateral. Both of the bilateral cases were also papillary and in each case both ovaries were removed. There were no deaths in this group. Eleven cases were followed on the average—2 years and 3 months. There were no recurrences.

Among the serous cystadenomata were found a number of adherent tumors—one of them intraligamentous. The cysts have ciliated cells and tend to invert in contradistinction to pseudomucinous cyst.

In true papillary cysts of whatever type there is a tendency to bilateral occurrence. Papillary cysts are prone to give rise to peritoneal implantation. The ovary continues their autonomous growth after the ovarian cyst has been removed. Therefore on account of the possibility of bilateral occurrence and peritoneal implantations it has been our rule in all true papillary cyst to remove the second ovary as a prophylactic measure.

By true papillaris meant epithelial proliferation in contradistinction to connective tissue projections covered with a single layer of epithelial cells. Our group of serous cystadenomata presented the two types in equal number. The relation of these two types remains undetermined as does the significance of the connective tissue projections.

There were nine carcinomata including several varieties. The most common form was the papillary cystadenocarcinoma. There were three of these and all of them died within a year after leaving hospital. There were two embryonal carcinomata formerly known as alveolar sarcoma or round cell sarcoma. Both patients died within a year. There was one squamous cell carcinoma originating in a dermoid. This patient died 4 months later of peritoneal carcinosis. One patient with a solid primary carcinoma died 4 days after

<sup>1</sup> The publication is a reprint of the report of the New York State Department of Health, Division of Hygiene and Prevention, New York, 1914.

operation. One case was classified as medullary carcinoma and the patient is alive and free from recurrence at 4 years. The tumor was unilateral and consisted of a large non-adherent cyst containing brownish serous fluid. The wall had a smooth internal surface except for a low elevation  $1\frac{1}{2}$  inch by 1 inch by 3 inches. This thickening consisted of a carcinomatous growth. The cell appeared embryonal in nature and in some respects the growth resembled an endothelioma (Fig. 1). The patient was 35 years old. The other ovary was left and to date has not shown recurrence.

Of the 15 dermoid cysts, only 5 were bilateral and 13 unilateral. There was one death

from peritonitis. Of the unilateral cases the other ovary was left in 12 and these patients were followed on the average of 23 months without apparent change in the other ovary.

There were 3 teratomata. All of them in girls of 8 years of age. The other ovary was normal and left in each case. One has been followed 1 year and the other two each 3 months without evidence of metastases or recurrence.

*Conclusions.* Conservative treatment of follicular and corpus luteum cysts is satisfactory.

Irrespective of the type of cyst, it is advisable to remove both ovaries when true epithelial papillae are found on one side.

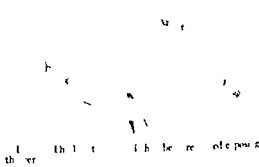
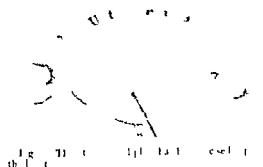
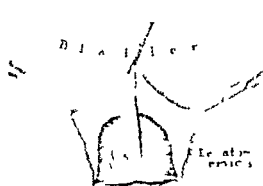
## LEVATOR CIRCULI UTERI

By F. C. D. ROSE, M.D., FAU.S., CHICAGO, ILL.

## ANATOMY

THE structure to which attention is called in the female is the prototypic of the levator prostaticus in the male. It has either escaped the anatomist's attention or has been dismissed with the terse description that the anterior fibers of the levator ani muscle descend upon the side of the vagina. In the male the anterior fibers form the levator ani muscle descending upon the side of the prostate gland and unite beneath it with the same muscle of the opposite side supporting the prostate as a muscular sling. Some anatomists describe it as a distinct muscle under the name of the levator prostaticus. Careful dissection in the female will demonstrate the same arrangement of muscle fibers with its fellow of the opposite side over the upper

end of the vagina and the cervix uteri forming a sling for the cervix uteri on its anterior or under surface when it is normally anteverted. Furthermore, these fibers are as distinct on the surface of the cervix in the female as on the prostate in the male. The muscle arises from the pubis with the puborectalis fibers it courses backward and internal to it along the side of the vagina converging over the anterior vaginal fornix and anterior surface of the cervix is inserted into the anterior surface of the cervix at the isthmus and fuses into the median aponeurotic raphe with the fibers of the same muscle of the opposite side. This median raphe is a strong fibrous or aponeurotic band extending throughout the middle portion of the uterine canal attachment. On either side of the median raphe the



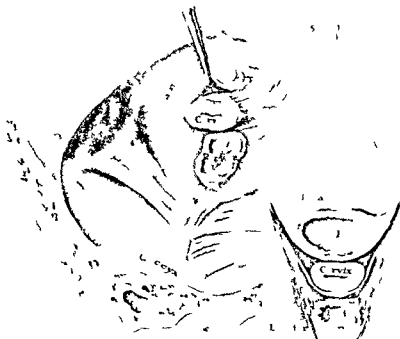


Fig. 3. Settlement on haw gill net flots and to ur ul

connection between the uterus and the bladder is of loose areolar tissue and easily separated by blunt dissection in the lines of cleavage. Not so with the median attachment which is dense and firmly adherent holding the base of the bladder in a longitudinal line firmly attached to the cervix uteri. This portion is separated with difficulty by blunt dissection and in the operation of hysterectomy is usually cut with scissors. The fibrous band of attachment between the bladder and uterus begins approximately 1 centimeter below the isthmus portio-supra-vaginal and extends downward and below on the vagina at its reflection on the cervix and between the vesicovaginal attachment

## SURGICAL ANATOMY

After the uterovesical plica of peritoneum is incised and blunt dissection of the bladder from the cervix uteri begun it is found that lateral to the midline the dissection is easy the lines of cleavage being loose. In the midline the fibrous connection is dense and closely adherent between the bladder and the cervix.

uter. So difficult frequently 1 blunt dissection in this area that it becomes necessary to incise this raph. As a matter of fact it is always better after the dissection is done bilaterally to lift up this midline and cut the adherent tissue with scissors. As soon as this is done the bladder is readily pushed forward well beyond the cervicovaginal junction. An incision is made with the knife 2 millimeters in depth and a half centimeter below the cut edge of the peritoneum (which point is immediately below the isthmus) and carried transversely across the cervix. From this point blunt dissection will push downward and forward a second layer of tissue off the anterior surface of the cervix to a point on the anterior vaginal wall from 1 to 2 centimeters below its reflection on the cervix. Lift up this band of tissue spread it out over the handle of a knife. Examination will prove it to be muscular fibers which extend into and fuse with the levator ani muscle. They are its anterior fibers and form in the female the same sort of a sling for support of the cervix uteri that they do in the male for the prostate gland.



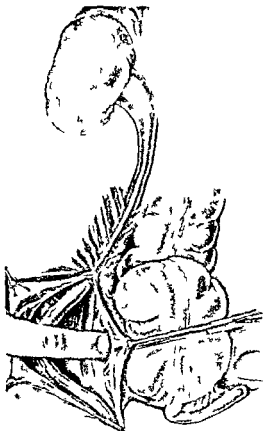
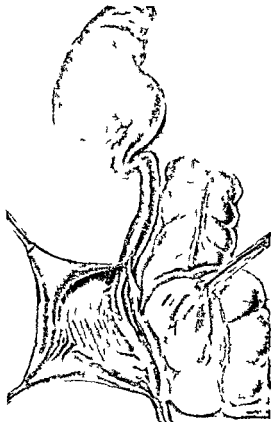
# DEPARTMENT OF TECHNIQUE

## RIGHT URETERAL OBSTRUCTION DUE TO SHORT CÆCAL MESENTERY

BY THOMAS N. HEPBURN, A.M., M.D., F.A.C.S., HARTFORD, CONNECTICUT

THERE is a group of cases giving a history of right renal colic following indiscretion in diet and intestinal distention which has perplexed me for some time. During the ordinary examination with the cystoscope, ureteral catheter and roentgen ray, the pain can be reproduced by distention of the renal pelvis. The ureterogram

will show moderate dilatation above the brim of the skeletal pelvis. Occasionally this dilatation is marked with the usual drain trap formation opposite the lower pole of the kidney. Surgical exploration of the ureter at the point where the dilatation begins, if made by the usual retroperitoneal route, will reveal nothing to explain its cause. The



For Trendelenburg position. Abdomen opened through right rectus incision. Cecum pulled over to right midline. Ureter pulled back through the posterior peritoneal partition. No dissection of structures.

First. The ureter has been transplanted to the iliac fossa. It will then drain the pelvis of the pericolic region. The cecum mobilized by free incision.



Fig 3. Ureter tilted distally at point of transition from normal ureter to dilated ureter. No thickening of the ureteral wall or sign of stricture and no mass pressing on the ureter to be palpated through the peritoneum.

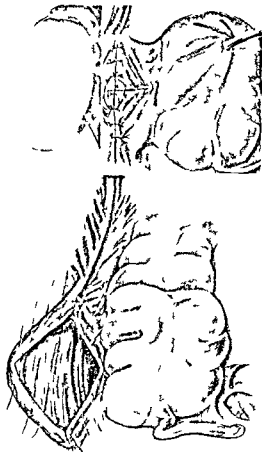


Fig 4. Short mesentery of the cecum pulling the ureter and causing obstruction at the point of transition from normal ureter to dilated ureter.

point of transition from normal ureter to dilated ureter found but there are no periureteral adhesions, no thickening of the ureteral wall or sign of stricture and no mass pressing on the ureter to be palpated through the peritoneum.

After several fruitless extraperitoneal explorations I began to explore transperitoneally through a right rectus incision and became impressed with the immobility of the cecum due to a short mesentery. The ureter when exposed by a longitudinal incision through the posterior parietal peritoneum was found to be dilated down to a point just opposite the cecum. Traction on the cecum would cause a pull and kink of the ureter greatest at the point of beginning dilatation. The mechanics of the intermittent ureteral obstruction could then be easily visualized.

Here we have a type of anatomy which allows perfect ureteral drainage under ordinary bowel

conditions but as soon as the cecum becomes unusually distended by gas as a result of indigestion the short mesentery is put on a strain. This kinks the underlying ureter causing distention of the ureter above and the pain in the kidney.

In an effort to correct this condition I have found the following operation simple and effective in the 2 cases in which I have tried it. The illustrations carry with them a description of the technique (Fig 1, 3 and 4).

Both patients operated upon had had appendectomies so they were familiar with postoperative pains. Following the previous operations the postoperative abdominal distention had accentuated the pain for which they sought relief. Following the operation I have described they both volunteered the information that the pain had been relieved. In 1 case 8 months and in the



pain and the motion being very gradual there are no sudden wrenches or twists to alarm the patient. The great power exerted by the screw permits a slow steady passage through the bone. The guillotine is then shifted toward the spine as far as may be desirable and the bone again divided. The loose piece of rib is extracted with forceps. It is absolutely necessary that the first section should be the more distal to prevent the

unsteadiness which would result if the rib were held by its anterior attachments only after having severed it near the spine.

It will be noted that the edge of the chisel stopped a fraction of a millimeter before it reaches the beak. This is to guard the edge from metallic contact.

I have tested this instrument thoroughly and it has never disappointed me.

## A LIVER PACK FOLLOWING CHOLECYSTECTOMY FOR ACUTE CHOLECYSTITIS

By ROBERT L. MASON, M.D., B.S., CHICAGO  
F. M. H. Lab. (1)

**T**HE question of drainage following cholecystectomy has not as yet been settled. However, in most clinics some form of drainage to the cystic duct and gall bladder fossa is used. In cholecystectomies for chronic cholelithiasis and cholecystitis where it is possible to adequately peritonealize the severed cystic duct and the denuded fossa in the liver, rubber dam or in less dry cases a cigarette drain suffices.

In cases of acute cholecystitis in which a gall bladder with thickened and friable walls is removed from the fundus downward there is no opportunity to save flaps for later peritonealization of the denuded area. An extensive oozing area in the liver bed is inevitable. A cigarette drain is inadequate because it cannot be made large enough to fill the area and the absorbing hemostatic end is limited to a small area in the region of the duct. Occasionally a gauze is applied to the gall bladder fossa in addition to the cigarette. This is later removed with difficulty. Adhesions of the pylorus to the gall bladder fossa are very apt to follow the use of such a drain.

The method of drainage in such cases as used in this clinic is as follows: After the removal of the gall bladder one or two sponges are pread out to fill the denuded area in the liver bed left by the enucleation of the gall bladder. These extend from the stump of the cystic duct well beyond the upper surface of the liver (Fig. 2). A sheet of rubber dam is then pread over the gauze reaching beyond the denuded area on each side for about 1 inch (Fig. 3). At the level of the peritoneum the rubber dam is wrapped around the gauze and tied after the manner of making a cigarette drain (Fig. 4). In this way the oozing in the liver bed is well taken care of, leakage of the ligated cystic duct guarded against and the possibility of adhesion to the surface of the liver is



Fig. 2. Denuded area in liver bed filled in with gauze.

neum the rubber dam is wrapped around the gauze and tied after the manner of making a cigarette drain (Fig. 4). In this way the oozing in the liver bed is well taken care of, leakage of the ligated cystic duct guarded against and the possibility of adhesion to the surface of the liver is



Fig. 1 Gauze applied to denuded area

Fig. 2 Sheet of rubber mapped over gauze

Fig. 3 Showing the drain completed

lessened. The drain is painlessly removed as an ordinary cigarette on the ninth day. The accom-

panying illustrations show the steps in the making of the drain.

## CORRESPONDENCE

### OIL STERILIZATION OF EDGED INSTRUMENTS

*To the Editor*—Through an oversight on our part credit was not given to Dr. Leland S. McKittick of Boston for his co-operation with Mr. Leo Pelkus in developing the oil sterilizer described under the title of "Oil Sterilization of Edged Instruments" in *Surgey Gynecology and Obstetrics* under date of August 1925. We wish to take this opportunity to correct the above oversight and to acknowledge Dr. McKittick's assistance to Mr. Pelkus.

FRA. A. LAHEY  
ROBERT L. MASON

Boston, Massachusetts

### COMMONWEALTH FUND OF NEW YORK AND RURAL HOSPITALS

*To the Editor*—With the purpose of improving rural medical nursing and hospital care the Com-

monwealth Fund of New York is offering to assist in the building of one hospital in a rural section. Certain conditions are laid down governing the distance from existing hospitals, the number of physicians to constitute the staff of the hospital, the character of the highways and transportation lines, and the willingness and ability of the community to defray deficits from operation. The Fund offers to pay two thirds of the cost of construction and equipment.

If the experience in building one such hospital seems to warrant an extension of the program the Fund will consider making a like offer to other districts needing a hospital. Applications are now being received and considered. It is probable that a decision as to the first unit will be made in the early fall.

HENRY C. WRIGHT, M.D.

Chief, Rural Hospitals

# EDITORIALS

## SURGERY, GYNECOLOGY AND OBSTETRICS

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Chief of Clinical Staff

DECEMBER, 1925

### THE NOMENCLATURE OF SKIN GRAFTING

It is essential when describing any surgical procedure to employ a standardized nomenclature so that there will be little if any chance of confusing the reader. A glance at various text books and at special articles on skin grafting will show that there is little uniformity in the descriptive terms used by the various authors when writing on this subject and a suggestion on the matter may be timely.

In the first place the distinction between a flap and a graft is apparently generally misunderstood. A *flap* is a mass of tissue which is attached at some portion of its periphery or base by a pedicle through which it receives its blood supply and which can be shifted only so far as its pedicle will allow.

A *skin flap* is made up of the whole thickness of the skin with as much subcutaneous tissue as is required.

A *graft* on the other hand is a mass of tissue which is cut free to be transplanted where desired and which receives its blood supply from the surface on which it is placed.

A *skin graft* consists of either the whole thickness or a portion of the thickness of the

skin with no subcutaneous tissue. Hence it can be seen that a flap and a graft are not synonymous terms.

At one time I included pedunculated *skin flap* in the group with whole thickness grafts but have since come to the conclusion that this is not correct and that on account of the difference in the surgical procedures, indication, blood supply and results flap and grafts should be considered as entirely separate entities.

Such terms as *tube graft*, *pedicle graft*, *flap graft* which definitely signify flaps and not grafts should not be listed as grafts.

How to designate the source from which the grafts are obtained also seems to be a matter of considerable difficulty. I use the term *autograft* a graft obtained from the patient himself, *isograft* a graft obtained from another individual of the same species, *homograft* a graft obtained from a lower species and prefer these since the older terms *homograft* and *heterograft* are frequently confused.

Well established types of grafts should also be correctly named but anyone who is familiar with the proper designations is aware that in many instances this is not the case. For example there is considerable confusion as to the difference between the true Reverdin graft and the small deep graft. The best way to settle the matter is to define what each type of graft is and then to mention some of the mistakes. Reverdin's description on December 15, 1869 of his own *greffe epidermique* is as follows — *j'enlevai avec la pointe d'une lancette au bras droit du malade deux petits lambeaux d'épiderme en ayant*

soin de raser autant que faire se pouvait le derme sans l'entamer. In 1872 he revised his description of what he still called *greffe epidermique* thus: "C'est que tout d'abord on ne coupe que dans le lambeau transplanté la coupe de tout l'épiderme et d'un peu de derme." Further on he says: "Pour ma part plusieurs greffes ont varié en étendue de 2 à 4 ou 6 millimètres carrés. J'ai toujours tâché de me rapprocher le plus possible de l'épiderme et de n'enlever que fort peu de derme."

From this it can be seen that Reverdin described the graft which is named for him at first as a pure epidermic graft and later found that it consisted of the epidermis and a very thin layer of the corium. In other words it was the thinnest graft that he could cut.

In 1914 I described grafts of about the same size as the Reverdin graft but differing in that they included practically the entire thickness of the corium and these I called *small deep grafts* which title has been generally accepted. These grafts differ from Reverdin grafts as much as whole thickness grafts differ from Ollier Thiersch grafts and should not be confused with the thin Reverdin grafts.

Both Reverdin and *small deep grafts* are occasionally called *pinch grafts* because at one time Reverdin grafts were obtained by pinching up a bit of skin with forceps and cutting it off with scissors. This method has been abandoned as it caused unnecessary trauma to the graft and it follows that the term *pinch graft* should also be discarded.

In a recent paper Reverdin grafts are described as *minute plugs of full thickness skin*. Others also evidently unfamiliar with what the true Reverdin graft is use the title

Reverdin graft and describe *small deep grafts*.

The large Ollier Thiersch graft is very thin and may be compared in thickness with the

true Reverdin graft. It consists of the epidermis and as thin a film of the corium as can be cut.

Not so long ago an author in a paper on Thiersch grafts said: "if after cutting the graft seems too thick the excess fat may be removed by trimming its under surface with curved scissors which of course indicates that if fat was present in the cases he was actually dealing with whole thickness grafts inasmuch as no ideally cut Ollier Thiersch graft should go deeper than the outer portion of the reticular layer of the corium."

The whole thickness (Wolfe Krause) graft consists of the entire thickness of the skin (epidermis and corium) down to the subcutaneous tissue.

In view of what skin grafts actually consist of it does not seem rational to divide them into dermal and epidermal types as there is no graft which is truly epidermal unless we use the epidermal film over a blister. It is impossible to cut from the normal skin with any apparatus now available a pure epidermic graft. The microscope shows that even the thinnest Reverdin grafts and the most skillfully cut Ollier Thiersch grafts contain a portion of the corium thus eliminating the term *epidermic* and making the term *thin* more desirable. Consequently it also seems wise to drop the term *dermal* and use the term *thick* for *small deep grafts* and grafts of the whole thickness of the skin.

Therefore I now propose that skin grafts be divided into two general types—*thin graft* and *thick graft*.

In the *thin graft* group should be placed the original *small thin Reverdin grafts* and the larger grafts (Ollier Thiersch) of the same thickness. In the *thick graft* group belong *small deep grafts* and *whole thickness* (Wolfe Krause) grafts.

JOHN STAGE DAVIS

## THE PRESENT STATUS OF ARTHROPLASTY

**S**URGERY until the present decade has offered no relief to those afflicted with ankylosed joints though efforts have been made for over 100 years to re-establish motion by operative procedures. This has been due in part to the limited experience of the surgeon who could not induce many to submit to operation when the chance of success was so slight and as the number operated upon by any one surgeon has been usually small and followed by recurrence there have been few advocates. Therefore statistics compiled from many and varied sources are not conclusive. Many problems have been elucidated by animal experiments in medicine and surgery but in bony ankylosis of joints such measures are of absolutely no value for it would be difficult to produce ankylosis in animals and impossible to obtain intelligent co-operation in the re-establishment of active motion which is positively essential. Consequently progress in this field has been achieved on the human subject by comparatively few surgeons in Europe and America. These experiments have been justifiable as a majority of ankylosed joints are in malposition and would be benefited by correction of the deformity even should mobilization fail. In the operative risk is almost negligible and the poorest end result could only terminate in recurrence of the former state.

The reconstruction of an ankylosed joint is divided into two stages: first a highly technical operative procedure which has been designated arthroplasty and second a rigid and persistent routine after treatment.

Arthroplasty not only prevents fusion between the bony surfaces as was the object of the early or inexperienced operator but restores the synchronous physiological action of all the component parts as the muscles

fascias ligaments etc. which constitute the function complex of a normal joint. Wide excision of bone in the upper extremity may produce motion but at the expense of stability it is merely a haphazard method of inducing pseudo arthrosis and should occupy no place in the surgery of ankylosed joints. Therefore excision should not be confused with arthroplasty. The goal must be the attainment of a joint that is stable strong and durable for unless this can be accomplished a stiff joint in the most advantageous position is far more desirable.

As with all innovations in surgery there is some difference of opinion as to operative technique but more regard should be given to reproducing normal function than anatomical detail. An interposing tissue should be inserted between the articular surfaces with the exception of the jaw and possibly the wrist. An autogenous transplant of free fascial lata can be obtained without additional risk and has been found desirable with a majority of operators.

The operative technique fails unless it is followed by an efficient and continuous after treatment for which intelligent co-operation of the patient is essential and can be secured in the average individual without difficulty. Fortitude and endurance are not required to an abnormal degree as seems to be the prevailing opinion. Active and passive motion is given through the aid of special apparatus adapted to the requirement of each joint but under the direct control of the patient. Motion is thus gradually restored with very little pain. Function must always be cultivated not forced. Expert physiotherapy is an excellent but expensive adjunct and by no means essential consequently the treatment is available to all regardless of financial status.

The scope of the procedure as well as the percentage of successful results increase with



the experience of the surgeon though care must always be exercised in the selection of case.

There are certain well known contraindications especially ankylosis as a sequel of tuberculosis which should be emphasized in any discussion of the subject. In fact surgical operation for the purpose of mobilization are rarely if ever permissible except when ankylosis has been caused by trauma or acute infections. Fortunately the latter is the etiological factor in the majority of ankylosed joints.

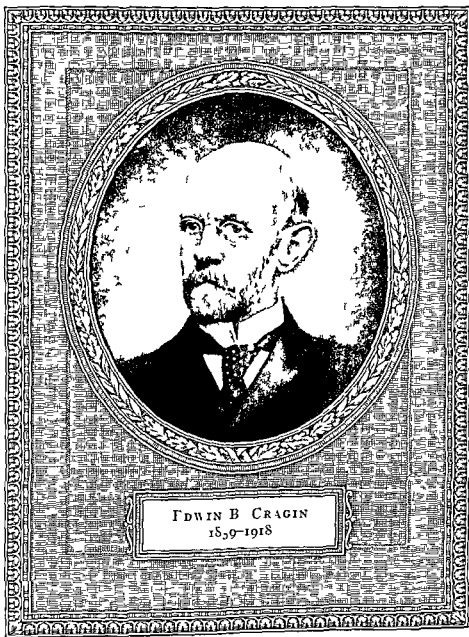
The best results are secured in young adults and very rarely is arthroplasty indicated above the age of 45 though all depends on the stamina of the individual. At present the operation is contraindicated in children as there is danger of injury to the epiphyses and it is difficult to secure co operation in the after treatment. The problem is more complicated in weight bearing joints but the object and principle is identical in all joints. The four most favorable joints for arthroplasty are the jaw elbow knee and hip. All ankylosed elbow with few exceptions should be mobilized. An ankylosed jaw compels social ostracism and is a menace to life from persistent oral sepsis therefore the operation may be considered in the light of an emergency and

should be performed in all cases. The social status must be considered in the knee and hip except in the young prior to vocational training when arthroplasty may be advised in all. The presence of double or poly ankylosis seriously complicates but does not contraindicate arthroplasty the management must be determined by further observation.

There is no retrograde tendency in successful cases in fact there is a gradual improvement in function for two or more years until approximately normal may be reached though the impression must not prevail that perfection has been attained. Evolution of the method is still in its infancy and there is yet much to be developed and standardized in surgical technique as well as after treatment by comparing and collaborating various methods. But from the results obtained during the past 10 years the future is most encouraging.

Arthroplasty has acquired a recognized status in surgery in other words has come to stay. The procedure however is not at present and probably never will be a routine operation to be indiscriminately employed though the technique may be acquired by any surgeon well trained in bone and joint surgery who is willing to give sufficient time to a rather intricate problem. WILLIS C. CAMPBELL





EDWIN B CRAGIN  
1859-1918

# MASTER SURGEONS OF AMERICA

## EDWIN BRADFORD CRAGIN

**E**DWIN Bradford Cragin was born in Colchester Connecticut October 23 1859 After a notable career he died in New York City October 21 1918

He represented the early New England lineage and the early New England ideals to a remarkable degree His father Edwin Timothy Cragin who had been a captain in the Seventh Regiment during the portion of his life which was spent in New York City died at a comparatively early age in Colchester His mother Ardelia Elizabeth Cragin lived to an advanced age She expressed in her character and activities the fine traditions of New England life She was a direct descendant of William Bradford one of the original settlers of the Plymouth Colony who came to this country in the Mayflower and became the first governor of that colony

Dr Cragin's boyhood was passed in Colchester He entered Yale College in the class of 1882 and there received the degree of A B He then spent a year in study and travel in the west In 1883 he entered the College of Physicians and Surgeons in New York City and was graduated in 1886 receiving the first Harrison purse of five hundred dollars for proficiency in examination He served his internship in the Roosevelt Hospital In June 1889 he was appointed assistant gynecologist to that institution In the same year he was also appointed assistant surgeon to the New York Cancer Hospital He served regularly in the Roosevelt Hospital on the gynecological division for 10 years doing a large amount of very successful work there At the New York Cancer Hospital he served for 4 years and then resigned

His services to the College of Physicians and Surgeons were very important From 1893 to 1895 he was assistant secretary and from 1895 to 1899 he was secretary of the faculty of that institution In 1898 after the resignation of James W McLane he was made lecturer in obstetrics and in 1899 he was appointed professor of obstetrics in the College and attending obstetrician in the Sloane Maternity Hospital

For 20 years he carried on the duties of these offices with marked success and ability During 14 years of this time the professorship of gynecology was also joined to that of obstetrics He believed that these departments should not be



clear that there was no question about its meaning and an enthusiasm which was captivating and inspiring

Yale University appreciated the notable work which he was doing and in 1907 in response to a request from his classmates conferred upon him the honorary degree of master of arts. Many important hospitals also appreciated the benefit of his counsel and friendship and elected him to their consulting boards. Among them we may mention the Roosevelt Hospital the Presbyterian Hospital the Lincoln Hospital the Infirmary for Women and Children the City Hospital the Nursery and Child's Hospital and the Italian Hospital all of them in New York City and St. Luke's Hospital Newburgh New York.

His family life was particularly happy. His marriage to Mary Randall Willard of Colchester occurred in 1889 and they and their children Miriam Alice and Edwin Bradford were most congenial. They formed a family circle of the real New England type.

In thus studying the character and actions of this notable man we find a character of the Puritan type with its strong adherence to duty and right a very unusual executive ability ability which would have placed him in the first rank in any occupation which he had sought. We find a great kindness and generosity a love for people and an appreciation of their needs a broad minded sympathy a wonderful courage and conviction. He was truly one of nature's noble men.

After Dr. Cragin's health began to fail in 1916 and 1917 he still kept at his work with great energy but even his constitution could not withstand the strain and he passed away in the autumn of 1918.

Anyone who witnessed the great honor paid to his memory at that time could appreciate that he was one of the great masters among men and among surgeons.

CHARLES A. DOWD



CHIRURGIE  
FRANCOISE

REVEILLIE PAR M.  
JAQUES DALECHAMPS  
Docteur Med. au St. Lefleur de  
dans l' de cette profes  
son à Lyon

Avec pi a figure des li men n'est  
 f un t p r n m u de.  
 La page prouven le princioeur bein de en  
 qui se du court en ceti ceuvre.



Offshore  
(Capitane Donato  
Alonso)

À LYON  
PAR GUYLLAUME ROVILLE  
M D LXX  
Avec privilege du Roy



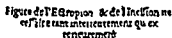
Addideris vocem fueris Dal champius ipso  
Expressa ad vivum cuius imago tunc.

Δὲ ἡ ἐκείνη ἡμέρα ἐπὶ τῇ πόλει ἡ ἀποκάλυψις  
ἐν μαθήσει αὐτῶν ὅτι οὐκ ἔστιν ἡμετέρα ἡ πόλις αὐτῶν

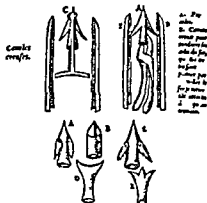
CHAPITRE LXXXVII. D

La manœuvre s'opère de deux manières : l'instrument se fixe sur de quelques centimètres soit.

*Boc de corbeaux*



A L'extrémité supérieure  
se trouve de long  
B L'extrémité inférieure  
se trouve de long  
au droit de l'extrémité.  
Les deux os  
sont bilobes.



A. Les cloentes qui servent à la dilatation, ou compression du  
 fr. duquel les al. s'écoulent en versant dans le corps & le venant  
 entre eux, s'appellent. B. fr. rond & pointu. C. Le  
 fr. d'écoulement. D. fr. tranchant ou pour de  
 trancher. E. Le fr. en forme de crible.





## REVIEWS OF NEW BOOKS IN SURGERY

THE first part of the second volume of the revised edition of Czerney and Keller's book is devoted to the nutritional disturbances of infancy and childhood. As in the first edition these disturbances are divided into three groups: those due to the food itself, those due to infection, and those due to constitutional abnormalities.

In discussing disturbances due to the food itself the authors retain their original classification which considered these injuries as the result of over feeding with certain food elements, namely fat, carbohydrate or protein. This will be of interest to student of pediatrics inasmuch as the classification of food disturbances as set forth by Finkelstein has perhaps been more generally accepted. The authors however defend their position by stating in the introduction to the present volume that neither their own studies nor the contributions of other writers have in their opinion justified a change in nomenclature. They believe that only further researches which shall change our conception of the nature of nutritional disturbances will warrant a new classification.

The text brings up to date their own life long studies and in addition furnishes a very extensive bibliography. To bring it to the attention of those interested in the subject matter would seem to fulfill the reviewer's task.

STANLEY GIBSON

THE subject of the physical diagnosis of surgical conditions is divided into the following sections: history taking, inspection, palpation, percussion, auscultation, mensuration, and the sense of smell as an aid to diagnosis. Routine laboratory technique and X-ray diagnosis are not included, emphasis being laid on the establishment of a diagnosis at the bedside with the five senses. The book is written especially for students. The descriptions are clear and concise and the illustrations are pictorially good.

*Chirurgische Propädeutik* is recommended to medical students who read German or to instructors preparing their courses in surgical physical diagnosis.

RALPH BOERNE BETTMAN

THE monograph *The Surgery of Pulmonary Tuberculosis* by John Alexander won the 1925 quinquennial Samuel D. Gross prize. The work is a complete covering of the whole field of surgical usefulness in pulmonary tuberculosis. The history, indications, technique, and results of all the surgical procedures applicable are discussed in detail. The bibliography with 500 references mentions practically all the important publications on the subject.

The reviewer feels that monographs such as this should be encouraged because in this manner all that is known on any one subject becomes readily available.

As a practical aid to the internist as well as to the surgeon Alexander's work is to be highly recommended.

RALPH BOERNE BETTMAN

THE work of Evans Graham while a member of the Empyema Commission of the United States Army was epoch making. As a result of his work our conception of the physiology of the chest and especially of the intrathoracic conditions produced by an open pneumothorax has been revolutionized.

Formerly it was thought that the mediastinum separated the chest into two compartments, which as far as intrathoracic pressure was concerned were separate and distinct. Now we know that in the case of an open pneumothorax the chest to all intents and purposes is to be regarded as one cavity and that both lungs collapse almost equally in the presence of a one-sided wide open thoracotomy wound.

Having established this fact by experiments on lower animals and fresh human cadavers, Graham applied his conclusions to the subject of the treatment of acute empyema.

The terrific mortality of the army camps as well as the high pre-war mortality in civil practice in acute empyema, as easily explained in the light of the findings that both lungs collapsed almost equally in the presence of an open thoracotomy. A normal person might tolerate an open pneumothorax, but a patient whose vital capacity was already lowered by the pneumonia concomitant to the empyema would succumb. Therefore Graham advocated either delaying opening the chest cavity until such a time as adhesions might have formed and thus prevent the collapse of the lung, or treating the empyema cavity by some method of closed drainage.

The results were spectacular. The mortality from empyema was reduced from a very high to a relative lull.

This book is the report and final analysis of Graham's work. The monograph records his experiments and resultant deduction. Every surgeon and physician treating empyema should be thoroughly conversant with this work and furthermore it should make its appeal to any collector of historic medical monographs, marking as it does one of the milestones in the advance of thoracic surgery.

RALPH BOERNE BETTMAN

WRITTEN from the special viewpoint of the student and general practitioner, the work of Dr. Hays on diseases of the ear, nose and throat

is a most valuable contribution to the literature of the specialty. The work is written in a clear, concise, and practical manner, and is well illustrated. It is a book that every student and general practitioner should have on his shelf.



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